

## FINAL JEE-MAIN EXAMINATION – JUNE, 2022

(Held On Monday 27<sup>th</sup> June, 2022)

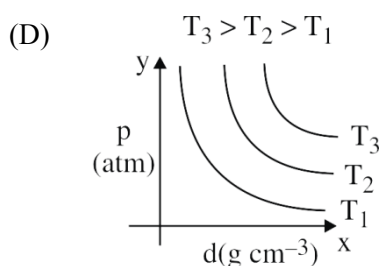
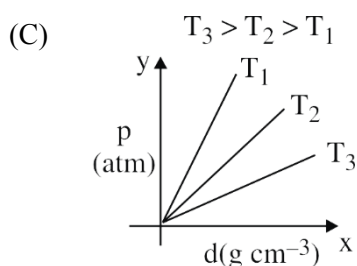
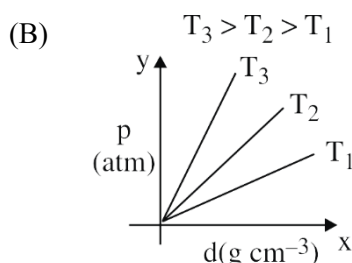
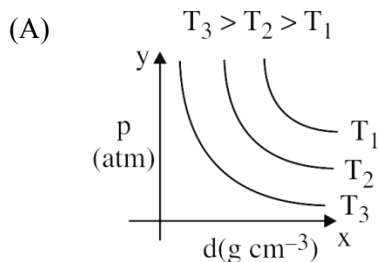
TIME : 3 : 00 PM to 6 : 00 PM

### CHEMISTRY

### TEST PAPER WITH SOLUTIONS

#### SECTION-A

1. Which amongst the given plots is the correct plot for pressure (p) vs density (d) for an ideal gas ?

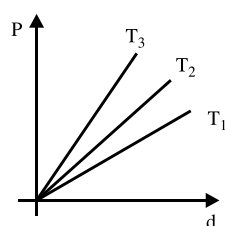


**Official Ans. by NTA (B)**

**Allen Ans. (B)**

**Sol.** P vs d :

$$P = \left( \frac{RT}{M} \right) d$$



$T_3 > T_2 > T_1$

2. Identify the **incorrect** statement for  $\text{PCl}_5$  from the following.

- (A) In this molecule, orbitals of phosphorous are assumed to undergo  $sp^3d$  hybridization.  
 (B) The geometry of  $\text{PCl}_5$  is trigonal bipyramidal.  
 (C)  $\text{PCl}_5$  has two axial bonds stronger than three equatorial bonds.  
 (D) The three equatorial bonds of  $\text{PCl}_5$  lie in a plane.

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

**Allen Ans. (C)**

**Sol.** In  $\text{PCl}_5$ , axial bonds are weaker than equatorial.

3. **Statement I : Leaching of gold** with cyanide ion in absence of air /  $\text{O}_2$  leads to cyano complex of  $\text{Au(III)}$ .

**Statement II : Zinc** is oxidized during the displacement reaction carried out for gold extraction.

In the light of the above statements, choose the correct 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 (D)**

**Allen Ans. (D)**

**Sol.** Statement-1 : wrong,  $\text{Au}^+$  is correct, not  $\text{Au}^{+3}$

Statement-2 : correct

4. The correct order of increasing intermolecular hydrogen bond strength is

- (A)  $\text{HCN} < \text{H}_2\text{O} < \text{NH}_3$   
 (B)  $\text{HCN} < \text{CH}_4 < \text{NH}_3$   
 (C)  $\text{CH}_4 < \text{HCN} < \text{NH}_3$   
 (D)  $\text{CH}_4 < \text{NH}_3 < \text{HCN}$

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

**Allen Ans. (C)**

**Sol.** Order of H-Bonding



5. The correct order of increasing ionic radii is

- (A)  $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-} < \text{N}^{3-}$   
 (B)  $\text{N}^{3-} < \text{O}^{2-} < \text{F}^- < \text{Na}^+ < \text{Mg}^{2+}$   
 (C)  $\text{F}^- < \text{Na}^+ < \text{O}^{2-} < \text{Mg}^{2+} < \text{N}^{3-}$   
 (D)  $\text{Na}^+ < \text{F}^- < \text{Mg}^{2+} < \text{O}^{2-} < \text{N}^{3-}$

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

**Allen Ans. (A)**

**Sol.**  $\text{N}^{3-} > \text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$  (Radii)

(Isoelectronic species)

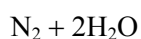
6. The gas produced by treating an aqueous solution of ammonium chloride with sodium nitrite is

- (A)  $\text{NH}_3$                       (B)  $\text{N}_2$   
 (C)  $\text{N}_2\text{O}$                       (D)  $\text{Cl}_2$

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

**Allen Ans. (B)**

**Sol.**  $\text{NH}_4\text{Cl} + \text{NaNO}_2 \rightarrow \text{NH}_4\text{NO}_2 + \text{NaCl}$



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

**Assertion A :** Flourine forms one oxoacid.

**Reason R :** Flourine has smallest size amongst all halogens and is highly electronegative

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 (A)**

**Allen Ans. (A)**

**Sol.** Both A and R are correct and R is the correct explanation of A.

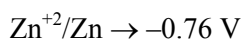
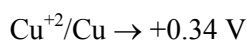
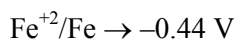
8. In 3d series, the metal having the highest  $M^{2+}/M$  standard electrode potential is

- (A) Cr                              (B) Fe  
 (C) Cu                              (D) Zn

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

**Allen Ans. (C)**

**Sol.**  $\text{Cr}^{+2}/\text{Cr} \rightarrow -0.90 \text{ V}$



So Ans.  $\text{Cu}^{+2}/\text{Cu}$

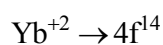
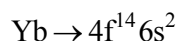
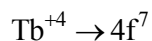
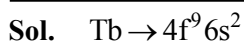
9. The 'f' orbitals are half and completely filled, respectively in lanthanide ions

(Given: Atomic no. Eu, 63; Sm, 62; Tm, 69; Tb, 65; Yb, 70; Dy, 66]

- (A)  $\text{Eu}^{2+}$  and  $\text{Tm}^{2+}$               (B)  $\text{Sm}^{2+}$  and  $\text{Tm}^{3+}$   
 (C)  $\text{Tb}^{4+}$  and  $\text{Yb}^{2+}$               (D)  $\text{Dy}^{3+}$  and  $\text{Yb}^{3+}$

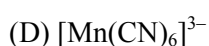
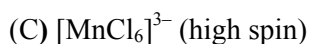
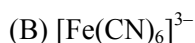
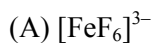
**Official Ans. by NTA (C)**

**Allen Ans. (C)**



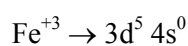
10. Arrange the following coordination compounds in the increasing order of magnetic moments.

(Atomic numbers: Mn = 25; Fe = 26)

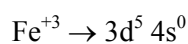
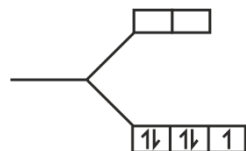
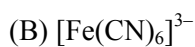


Official Ans. by NTA (B)

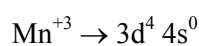
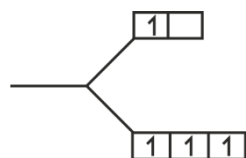
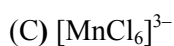
Allen Ans. (B)



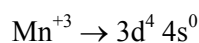
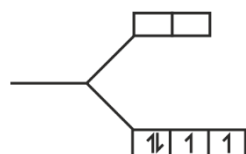
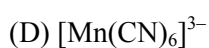
$n = 5$



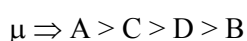
$n = 1$



$n = 4$



$n = 2$

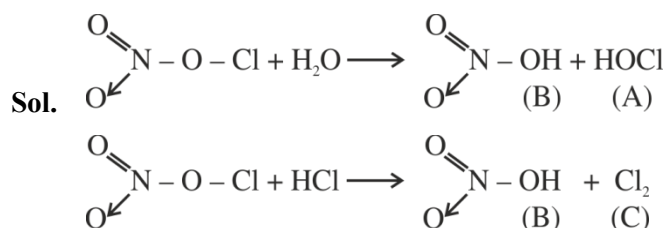


11. On the surface of polar stratospheric clouds, hydrolysis of chlorine nitrate gives A and B while its reaction with HCl produces B and C. A, B and C are, respectively



Official Ans. by NTA (A)

Allen Ans. (A)



12. Which of the following is most stable?

(A)



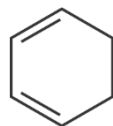
(B)



(C)

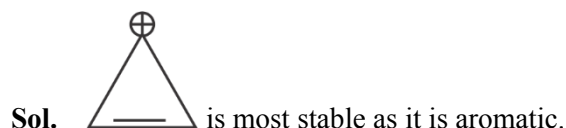


(D)

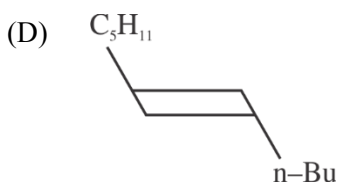
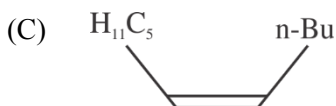
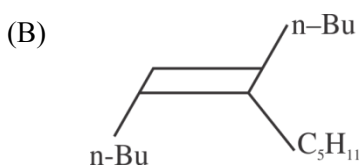
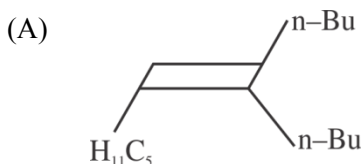
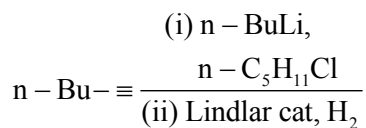


Official Ans. by NTA (A)

Allen Ans. (A)

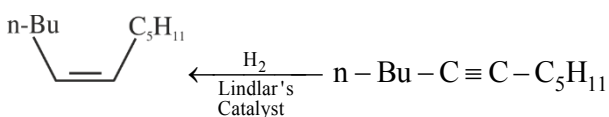
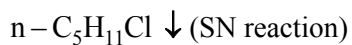
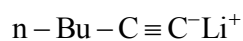


13. What will be the major product of following sequence of reactions?

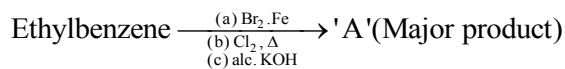


Official Ans. by NTA (C)

Allen Ans. (C)



14. Product 'A' of following sequence of reactions is

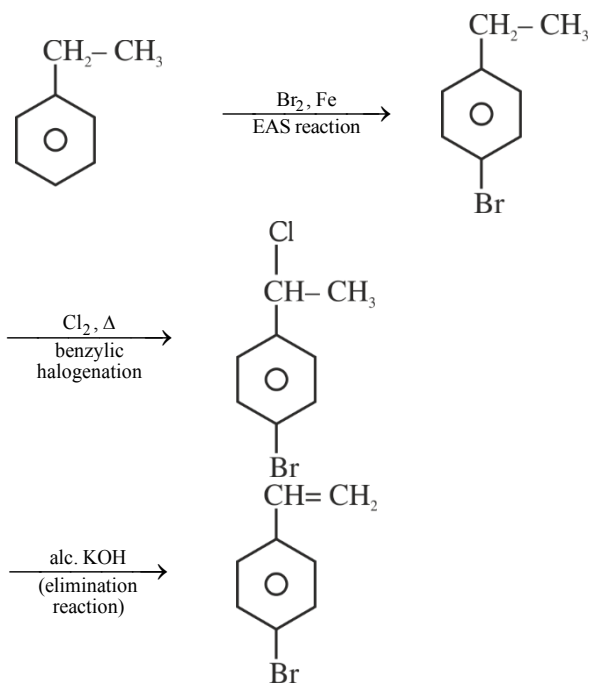


(A)	
(B)	
(C)	
(D)	

Official Ans. by NTA (D)

Allen Ans. (D)

Sol.





**Sol.** It is copolymerization of 1, 3-butadiene and acrylonitrile.

**18.** Given below are two statements.

**Statements I:** Maltose has two  $\alpha$ -D-glucose units linked at  $C_1$  and  $C_4$  and is a reducing sugar.

**Statement II:** Maltose has two monosaccharides:  $\alpha$ -D-glucose and  $\beta$ -D-glucose linked at  $C_1$  and  $C_6$  and it is a non-reducing sugar.

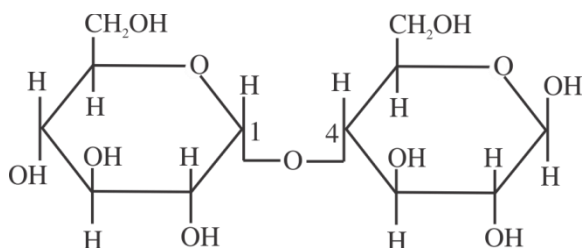
In the light of the above statements, choose the correct answer from the options given below.

- (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 (C)**

**Allen Ans. (C)**

**Sol.**



Maltose

**19.** Match List I with List II

List I	List II
A. Antipyretic	I. Reduces pain
B. Analgesic	II. Reduces stress
C. Tranquilizer	III. Reduces fever
D. Antacid	IV. Reduces acidity (Stomach)

Choose the correct answer from the options given below:

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

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

**Allen Ans. (A)**

**Sol.**

A. Antipyretic	Reduces fever
B. Analgesic	Reduces pain
C. Tranquilizer	Reduces stress
D. Antacid	Reduces acidity (Stomach)

**20.** Match List I with List II

List I	List II
(Anion)	(Gas evolved on reaction with dil. $H_2SO_4$ )
A. $CO_3^{2-}$	I. Colourless gas which turns lead acetate paper black
B. $S^{2-}$	II. Colourless gas which turns acidified potassium dichromate solution green.
C. $SO_3^{2-}$	III. Brown fumes which turns acidified KI solution containing starch blue.
D. $NO_2^-$	IV. Colourless gas evolved with brisk effervescence, which turns lime water milky.

Choose the correct answer from the options given below:

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

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

**Allen Ans. (D)**

**Sol.**  $CO_3^{2-}$  will give  $CO_2(g)$  which will turns lime water milky.

$S^{2-}$  will give  $H_2S(g)$ , will turns lead acetate paper black

$SO_3^{2-}$  will give  $SO_2(g)$ , which will turns acidified potassium dichromate solution green.

$NO_2^-$  will give brown  $NO_2(g)$  will turn KI solution blue.

## SECTION-B

1. 116 g of a substance upon dissociation reaction, yields 7.5 g of hydrogen, 60g of oxygen and 48.5 g of carbon. Given that the atomic masses of H, O and C are 1, 16 and 12 respectively. The data agrees with how many formulae of the following?

(A) CH<sub>3</sub>COOH (B) HCHO  
 (C) CH<sub>3</sub>OOCH<sub>3</sub> (D) CH<sub>3</sub>CHO

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

**Allen Ans. (2)**

**Sol.** %H =  $\frac{7.5}{116} \times 100 = 6.5$

%O =  $\frac{60}{116} \times 100 = 51.7$

%C =  $\frac{48.5}{116} \times 100 = 41.8$

Relative atomicities = H  $\Rightarrow$  6.5

O  $\Rightarrow$   $\frac{51.7}{16} = 3.25$

C  $\Rightarrow$   $\frac{41.8}{12} = 3.5$

Empirically formula is approx.. CH<sub>2</sub>O

(A) C<sub>2</sub>H<sub>4</sub>O<sub>2</sub> (B) CH<sub>2</sub>O relate to this formula.

2. Consider the following set of quantum numbers

	n	l	m <sub>l</sub>
A.	3	3	-3
B.	3	2	-2
C.	2	1	+1
D.	2	2	+2

The number of correct sets of quantum numbers is \_\_\_\_\_

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

**Allen Ans. (2)**

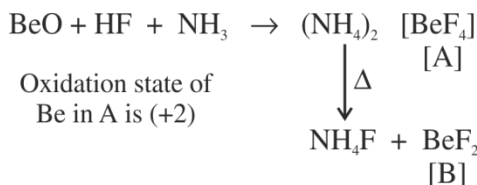
- Sol.** Quantum no. of set (B) and (C) can be correct.  
 (A) and (D) are wrong as  $n = l$  is not possible.

3. BeO reacts with HF in presence of ammonia to give [A] which on thermal decomposition produces [B] and ammonium fluoride. Oxidation state of Be in [A] is \_\_\_\_\_

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

**Allen Ans. (2)**

**Sol.**



4. When 5 moles of He gas expand isothermally and reversibly at 300 K from 10 litre to 20 litre, the magnitude of the maximum work obtained is \_\_\_\_\_ J. [nearest integer] (Given: R = 8.3 J K<sup>-1</sup> mol<sup>-1</sup> and log 2 = 0.3010)

**Official Ans. by NTA (8630)**

**Allen Ans. (8630)**

**Sol.** n = 5 mol

T = 300 K

V<sub>1</sub> = 10 L

V<sub>2</sub> = 20 L

$$w = -nRT \ln \frac{V_2}{V_1}$$

$$= -5 \times 8.3 \times 300 \times \ln \frac{20}{10}$$

$$= -8630.38 \text{ J}$$

5. A solution containing  $2.5 \times 10^{-3}$  kg of a solute dissolved in  $75 \times 10^{-3}$  kg of water boils at 373.535 K. The molar mass of the solute is \_\_\_\_\_ g mol<sup>-1</sup>. [nearest integer] (Given: K<sub>b</sub> (H<sub>2</sub>O) = 0.52 K Kg mol<sup>-1</sup>, boiling point of water = 373.15K)

**Official Ans. by NTA (45)**

**Allen Ans. (45)**

**Sol.**  $w = 2.5 \text{ g}$   $K_b = 0.52$   
 $w_{\text{solvent}} = 75 \text{ g}$   $M = \text{Mol. Wt. of solute}$   
 $T'_B = 373.535 \text{ K}$   
 $T_B^{\circ} = 373.15 \text{ K}$   
 $\Delta T_B = 0.385 = K_b \text{ molality}$   
 $0.385 = 0.52 \times \left( \frac{2.5}{M} \times \frac{1000}{75} \right)$   
 $M = 45 \text{ g mol}^{-1}$

6. pH value of 0.001 M NaOH solution is \_\_\_\_\_.

**Official Ans. by NTA (11)**

**Allen Ans. (11)**

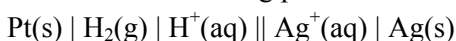
**Sol.** 0.001 M NaOH

$$[\text{OH}^-] = 10^{-3}$$

$$\text{pOH} = 3$$

$$\text{pH} = 11$$

7. For the reaction taking place in the cell:

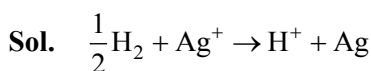


$$E^{\circ}_{\text{cell}} = +0.5332 \text{ V.}$$

The value of  $\Delta_r G^{\circ}$  is \_\_\_\_\_  $\text{kJ mol}^{-1}$ . (in nearest integer)

**Official Ans. by NTA (51)**

**Allen Ans. (51 or 103)**



$$\Delta G^{\circ} = -nE^{\circ} F$$

$$= -1 \times 0.5332 \times 96500 \text{ J}$$

$$= -51.35 \text{ kJ}$$

$$(n = 2 \text{ for } \text{H}_2 + 2\text{Ag}^+ \rightarrow 2\text{H}^+ + 2\text{Ag})$$

8. It has been found that for a chemical reaction with rise in temperature by 9K the rate constant gets doubled. Assuming a reaction to be occurring at 300 K, the value of activation energy is found to be \_\_\_\_\_  $\text{kJ mol}^{-1}$ . [nearest integer]

(Given  $\ln 10 = 2.3$ ,  $R = 8.3 \text{ JK}^{-1} \text{ mol}^{-1}$ ,  $\log 2 = 0.30$ )

**Official Ans. by NTA (59)**

**Allen Ans. (59)**

**Sol.**  $\log_{10} \frac{K_2}{K_1} = \frac{E_a}{2.303R} \left( \frac{1}{300} - \frac{1}{309} \right)$

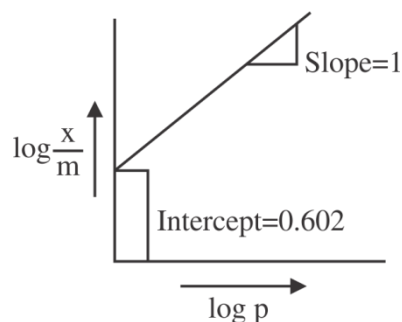
$$0.3 = \frac{E_a}{2.303 \times 8.3} \left( \frac{9}{300 \times 309} \right)$$

$$E_a = \frac{0.3 \times 2.303 \times 8.3 \times 300 \times 309}{9}$$

$$= 59065.04 \text{ J}$$

$$E_a = 59.06 \text{ kJ}$$

9.



If the initial pressure of a gas is 0.03 atm, the mass of the gas adsorbed per gram of the adsorbent is \_\_\_\_\_  $\times 10^{-2} \text{ g}$ .

**Official Ans. by NTA (12)**

**Allen Ans. (12)**

**Sol.**  $\frac{x}{m} = kP^n$

$$\log \frac{x}{m} = \log k + \frac{1}{n} \log P$$

From graph

$$\text{Slope} = \frac{1}{n} = 1 \Rightarrow n = 1$$

$$\text{Intercept} = \log k = 0.602$$

$$k = 4$$

$$\frac{x}{m} = 4 \times (0.03)^1$$

$$\frac{x}{m} = 12 \times 10^{-2}$$

10. 0.25 g of an organic compound containing chlorine gave 0.40 g of silver chloride in Carius estimation. The percentage of chlorine present in the compound is \_\_\_\_\_. [in nearest integer]

(Given: Molar mass of Ag is  $108 \text{ g mol}^{-1}$  and that of Cl is  $35.5 \text{ g mol}^{-1}$ )

**Official Ans. by NTA (40)**

**Allen Ans. (40)**

**Sol.** wt. of organic compound = 0.25 g

$$\text{mass of Cl} = \frac{35.5}{143.5} \times 0.4 \text{ g}$$

mass % of Cl in the organic compound

$$= \frac{35.5 \times 0.4}{143.5 \times 0.25} \times 100$$

$$= 39.58\%$$