

**JEE–MAIN EXAMINATION – JUNE, 2022**

**26 June S - 02 Paper Solution**

**SECTION-A**

1. The number of radial and angular nodes in 4d orbital are, respectively

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

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

**Allen Ans. (A)**

**Sol.** Radial node =  $n - l - 1$   
=  $4 - 2 - 1$   
= 1

Angular node ( $l$ ) = 2

2. Match List I with List II.

List I Enzyme	List II Conversion of
A. Invertase	I. Starch into maltose
B. Zymase	II. Maltose into glucose
C. Diastase	III. Glucose into ethanol
D. Maltase	IV. Cane sugar into glucose

Choose the most appropriate answer from the options given below :

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

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

**Allen Ans. (C)**

**Sol.** Invertase : Cane sugar → Glucose and fructose

Zymase : Glucose → Ethanol and CO<sub>2</sub>

Diastase : Starch → Maltose

Maltase : Maltose → Glucose

3. Which of the following elements is considered as a metalloid?

(A) Sc      (B) Pb      (C) Bi      (D) Te

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

**Allen Ans. (D)**

**Sol.** Sc, Pb, Bi are metals  
Te is a metalloid

4. The role of depressants in Froth Flotation method\* is to

(A) selectively prevent one component of the ore from coming to the froth.  
(B) reduce the consumption of oil for froth formation.  
(C) stabilize the froth.  
(D) enhance non-wettability of the mineral particles.

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

**Allen Ans. (A)**

**Sol.** Depressant prevent one component from coming to the froth.

For eg., in Galena ore, the depressant (NaCN) prevents impurity (ZnS) from coming to the froth.

5. Boiling of hard water is helpful in removing the temporary hardness by converting calcium hydrogen carbonate and magnesium hydrogen carbonate to

(A) CaCO<sub>3</sub> and Mg(OH)<sub>2</sub>  
(B) CaCO<sub>3</sub> and M<sub>2</sub>CO<sub>3</sub>  
(C) Ca(OH)<sub>2</sub> and MgCO<sub>3</sub>  
(D) Ca(OH)<sub>2</sub> and Mg(OH)<sub>2</sub>

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

**Allen Ans. (A)**

**Sol.**  $Mg(HCO_3)_2 \xrightarrow{\text{Boil}} Mg(OH)_2 + 2CO_2 \uparrow$   
 $Ca(HCO_3)_2 \xrightarrow{\text{Boil}} CaCO_3 + H_2O + CO_2 \uparrow$

6. s-block element which cannot be qualitatively confirmed by the flame test is

(A) Li      (B) Na      (C) Rb      (D) Be

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

**Allen Ans. (D)**

**Sol.**

Li	Crimson Red
Na	Yellow
Rb	Red violet
Be	No color

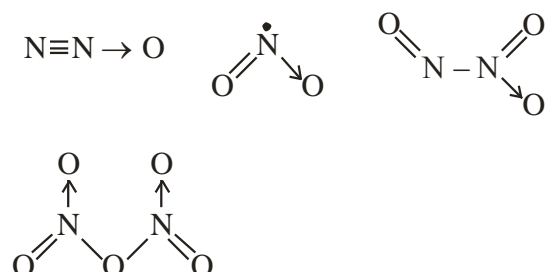
7. The oxide which contains an odd electron at the nitrogen atom is

- (A)  $N_2O$  (B)  $NO_2$  (C)  $N_2O_3$  (D)  $N_2O_5$

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

**Allen Ans. (B)**

**Sol.**



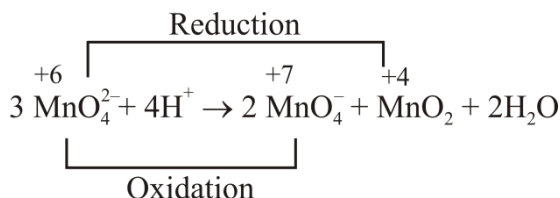
8. Which one of the following is an example of disproportionation reaction?

- (A)  $3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$   
 (B)  $MnO_4^{2-} + 4H^+ + 4e^- \rightarrow MnO_2 + 2H_2O$   
 (C)  $10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$   
 (D)  $8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$

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

**Allen Ans. (A)**

**Sol.**



9. The most common oxidation state of Lanthanoid elements is +3. Which of the following is likely to deviate easily from +3 oxidation state?

- (A) Ce (At. No. 58) (B) La (At. No. 57)  
 (C) Lu (At. No. 71) (D) Gd (At. No. 64)

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

**Allen Ans. (A)**

**Sol.** Ce = [Xe]  $4f^1 5d^1 6s^2$

Ce<sup>3+</sup> = [Xe]  $4f^1 5d^0$

Ce<sup>+4</sup> = [Xe]  $4f^0 5d^0$  (Noble gas configuration)

10. The measured BOD values for four different water samples (A-D) are as follows:

A = 3 ppm: B=18 ppm: C=21 ppm: D=4 ppm. The water samples which can be called as highly polluted with organic wastes, are

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

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

**Allen Ans. (C)**

**Sol.** Clean water  $\rightarrow$  B.O.D. < 5 ppm

Highly polluted water  $\rightarrow$  B.O.D. > 17 ppm

11. The correct order of nucleophilicity is

- (A)  $F^- > OH^-$  (B)  $H_2\ddot{O} > OH^-$   
 (C)  $R\ddot{O}H > RO^-$  (D)  $NH_2^- > NH_3$

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

**Allen Ans. (D)**

**Sol.** Nucleophilicity  $\propto$  electro density on donor atom  
 $\propto$  size of donor atom (in gas)

$$\propto \frac{1}{EN \text{ of atom}} \quad (\text{for period})$$

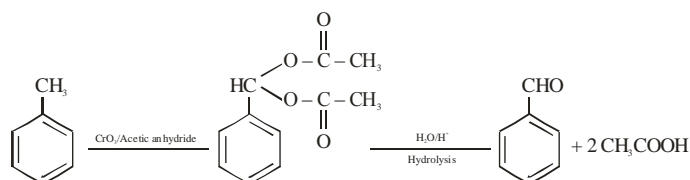
12. Oxidation of toluene to Benzaldehyde can be easily carried out with which of the following reagents?

- (A)  $CrO_3$ /acetic acid,  $H_3O^+$   
 (B)  $CrO_3$ /acetic anhydride,  $H_3O^+$   
 (C)  $KMnO_4/HCl$ ,  $H_3O^+$   
 (D)  $CO/HCl$ , anhydrous  $AlCl_3$

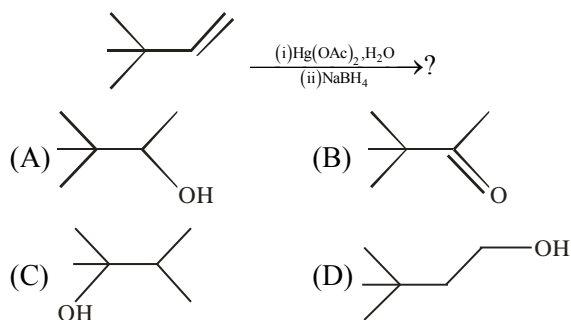
**Official Ans. by NTA (B)**

**Allen Ans. (B)**

**Sol.**

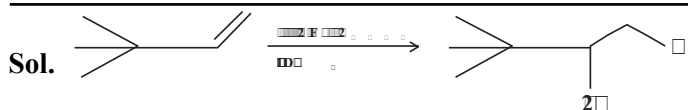


13. The major product in the following reaction



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

**Allen Ans. (A)**

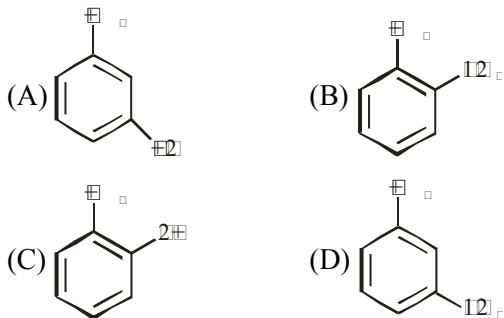


Oxymercuration – Demercuration

Addition of H<sub>2</sub>O

Markovnikov's addition without rearrangement

14. Halogenation of which one of the following will yield m-substituted product with respect to methyl group as a major product?

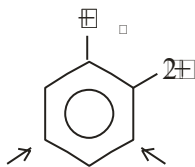


Official Ans. by NTA (C)

Allen Ans. (C)

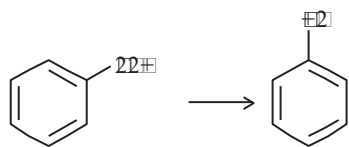
- Sol. Electrophile will attack at ortho and para position with respect to better electron releasing group (ERG)

ERG : -OH > -CH<sub>3</sub>



Para position with respect to -OH (+R) group and it will be meta position with respect to -CH<sub>3</sub> group.

15. The reagent, from the following, which converts benzoic acid to benzaldehyde in one step is

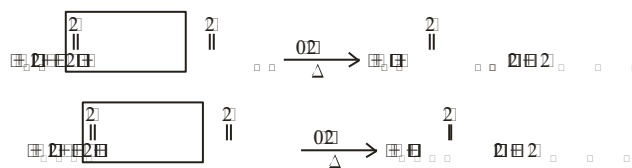


- (A) LiAlH<sub>4</sub> (B) KMnO<sub>4</sub>  
(C) MnO (D) NaBH<sub>4</sub>

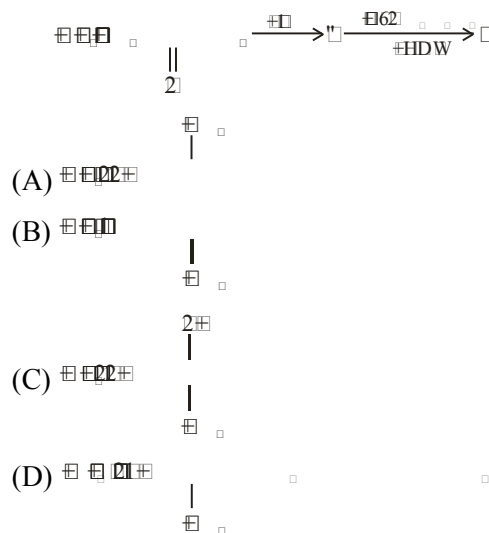
Official Ans. by NTA (C)

Allen Ans. (D)

Sol.



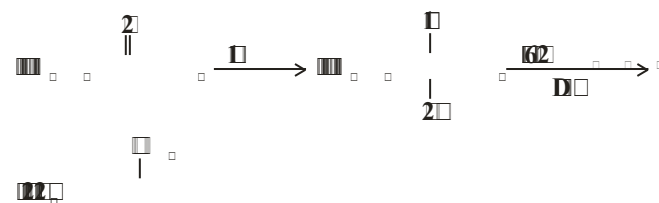
16. The final product 'A' in the following reaction sequence



Official Ans. by NTA (A)

Allen Ans. (A)

Sol.



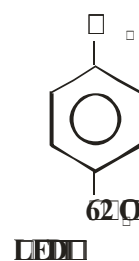
17. Which statement is NOT correct for p-toluenesulphonyl chloride?

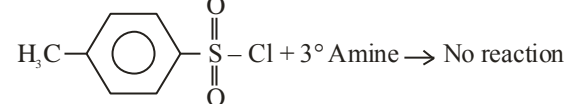
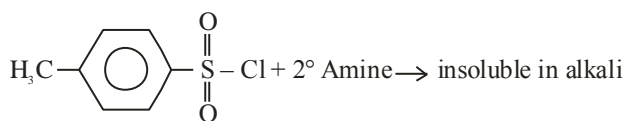
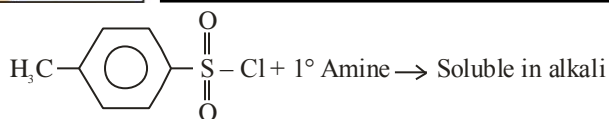
- (A) It is known as Hinsberg's reagent.  
(B) It is used to distinguish primary and secondary amines.  
(C) On treatment with secondary amine, it leads to a product, that is soluble in alkali.  
(D) It doesn't react with tertiary amines.

Official Ans. by NTA (C)

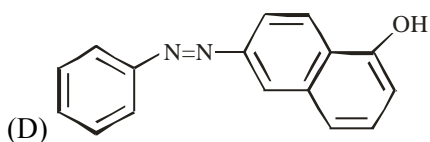
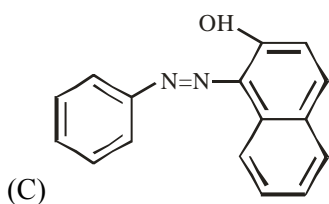
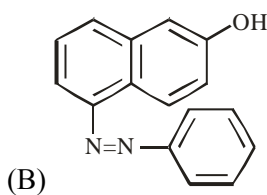
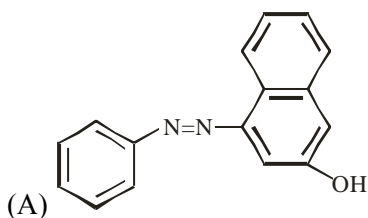
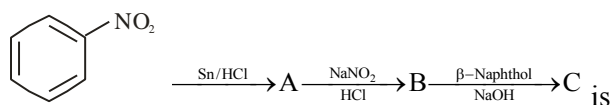
Allen Ans. (C)

Sol.



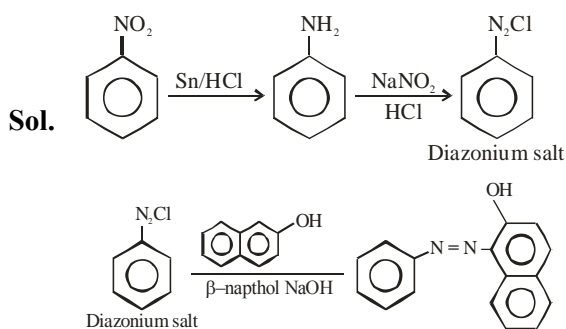


18. The final product 'C' is the following series series of reactions

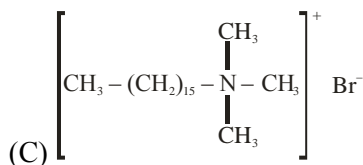
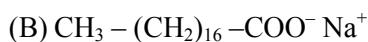
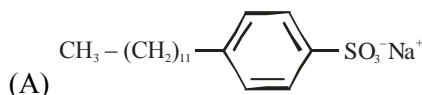


Official Ans. by NTA (C)

Allen Ans. (D)



19. Which of the following is NOT an example of synthetic detergent?



Official Ans. by NTA (B)

Allen Ans. (B)

Sol. Refer NCERT (Page No. 452)

20. Which one of the following is a water soluble vitamin, that is not excreted easily?



Official Ans. by NTA (D)

Allen Ans. (D)

Sol. Refer NCERT (Page No. 426)

### SECTION-B

1. CNG is an important transportation fuel. When 100 g CNG is mixed with 208 oxygen in vehicles, it leads to the formation of CO<sub>2</sub> and H<sub>2</sub>O and produces large quantity of heat during this combustion, then the amount of carbon dioxide, produced in grams is \_\_\_\_\_. [nearest integer]

[Assume CNG to be methane]

Official Ans. by NTA (143)

Allen Ans. (143)

Sol.  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

	$\frac{100}{16}$	$\frac{208}{32}$	
Mole			
	$= 6.25$	$= 6.5$	

$\frac{\text{Mole}}{\text{Stoi. Coeff.}}$	$\frac{6.25}{1}$	$\frac{6.5}{2}$	$= 3.25$
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So, O<sub>2</sub> is limiting reagent

Mole – Mole analysis

$$\frac{n_{O_2}}{2} = \frac{n_{CO_2}}{1}$$

$$\frac{6.5}{2} = n_{CO_2}$$

$$\text{Mass of } CO_2 = \frac{6.5}{2} \times 44 = 143 \text{ gm}$$

2. In a solid AB. A atoms are in ccp arrangement and B atoms occupy all the octahedral sites. If two atoms from the opposite faces are removed, then the resultant stoichiometry of the compound is  $A_xB_y$ . The value of x is \_\_\_\_\_. [nearest integer]

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

**Allen Ans. (3)**

**Sol.**  $A \rightarrow 4 - \left(2 \times \frac{1}{2}\right) = 3$

$$B \rightarrow 12 \times \frac{1}{4} + 1 \times 1 = 4$$

So, Compound is  $A_3B_4$

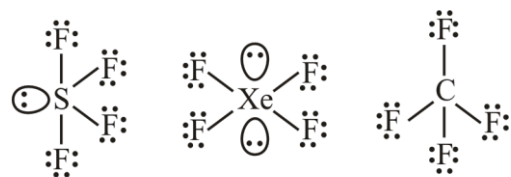
The value of x is 3.

3. Amongst  $SF_4$ ,  $XeF_4$ ,  $CF_4$  and  $H_2O$ , the number of species with two lone pairs of electrons \_\_\_\_\_.

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

**Allen Ans. (1)**

**Sol.**

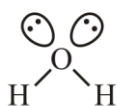


Total lone pairs = 13

Total lone pairs = 14

Total lone pairs = 12

Total lone pairs = 2



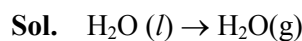
4. A fish swimming in water body when taken out from the water body is covered with a film of water of weight 36 g. When it is subjected to cooking at  $100^\circ C$ , then the internal energy for vaporization in  $\text{kJ mol}^{-1}$  is \_\_\_\_\_. [nearest integer]

[Assume steam to be an ideal gas. Given  $A_{\text{vap}}H^\ominus$

for water at  $373 \text{ K}$  and  $1 \text{ bar}$  is  $41.1 \text{ kJ mol}^{-1}$ ;  $R = 8.31 \text{ JK}^{-1}\text{mol}^{-1}$ ]

**Official Ans. by NTA (38)**

**Allen Ans. (38)**



$$n = \frac{36}{18} = 2 \text{ mol}$$

$$\Delta U = \Delta H - \Delta n_g RT$$

$$= 41.1 - \frac{1 \times 8.31 \times 373}{1000} \text{ kJ/mol}$$

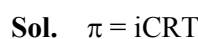
$$= 38 \text{ kJ/mol}$$

5. The osmotic pressure exerted by a solution prepared by dissolving  $2.0 \text{ g}$  of protein of molar mass  $60 \text{ kg mol}^{-1}$  in  $200 \text{ mL}$  of water at  $27^\circ C$  is \_\_\_\_\_ Pa. [integer value]

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

**Official Ans. by NTA (415)**

**Allen Ans. (415)**



$$= \frac{1 \times 2}{60000 \times 0.2} \times 0.083 \times 300$$

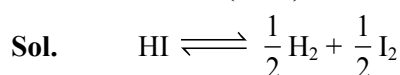
$$= 0.00415 \text{ bar} \quad (\because 1 \text{ bar} = 10^5 \text{ Pa})$$

So,  $0.00415 \times 10^5 \text{ Pa} = 415 \text{ Pa}$

6.  $40^\circ$  of  $HI$  undergoes decomposition to  $H_2$  and  $I_2$  at  $300 \text{ K}$ .  $\Delta G^\ominus$  for this decomposition reaction at one atmosphere pressure is \_\_\_\_\_  $\text{J mol}^{-1}$ . [nearest integer]  
(Use  $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ ;  $\log 2 = 0.3010$ .  $\ln 10 = 2.3$ ,  $\log 3 = 0.477$ )

**Official Ans. by NTA (2735)**

**Allen Ans. (2735)**



$$t_i \quad 1$$

$$t_{eq} \quad 1 - 0.4 \quad \frac{0.4}{2} \quad \frac{0.4}{2}$$

$$K_p = \frac{(0.2)^{\frac{1}{2}} (0.2)^{\frac{1}{2}}}{1 - 0.4} = \frac{0.2}{0.6} = \frac{1}{3}$$

$$\Delta G = \Delta G^\circ + RT \ln K = 0$$

$$\Delta G^\circ = -RT \ln K \Rightarrow -8.31 \times 300 \times 2.3 \times \log\left(\frac{1}{3}\right)$$

$$= 2735 \text{ J/mol}$$



The Gibbs free energy change for the above reaction at 298 K is  $x \times 10^{-1} \text{ kJ mol}^{-1}$ ;

The value of x is \_\_\_\_\_. [nearest integer]

$$[\text{Given: } E_{\text{Cu}^{2+}/\text{Cu}}^\ominus = 0.34\text{V}; E_{\text{Sn}^{2+}/\text{Sn}}^\ominus = -0.14\text{V}; F = 96500\text{C mol}^{-1}]$$

**Official Ans. by NTA (983)**

**Allen Ans. (983)**



$$\begin{aligned} E_{\text{cell}}^\circ &= E_{\text{cathode}}^\circ - E_{\text{anode}}^\circ \\ &= -0.14 - (0.34) \\ &= -0.48 \text{ V} \end{aligned}$$

$$\begin{aligned} E_{\text{cell}} &= E_{\text{cell}}^\circ - \frac{0.059}{2} \log \frac{[\text{Cu}^{2+}]}{[\text{Sn}^{2+}]} \\ &= -0.48 - \frac{0.059}{2} \log \frac{0.01}{0.001} \\ &= -0.509 \end{aligned}$$

$$\begin{aligned} \Delta G &= -nF E_{\text{cell}} \\ &= -2 \times 96500 \times (-0.5095) \\ &= 98333.5 \text{ J/mol} \\ &= 98.335 \text{ kJ/mol} \\ &= 983.35 \times 10^{-1} \text{ kJ/mol} \end{aligned}$$

Nearest Integer : 983

8. Catalyst A reduces the activation energy for a reaction by  $10 \text{ kJ mol}^{-1}$  at 300 K. The ratio of rate

constants,  $\frac{k_{\text{T,Catalysed}}}{k_{\text{T,Uncatalysed}}}$  is  $e^x$ . The value of x is \_\_\_\_\_. [nearest integer]

[Assume that the pre-exponential factor is same in both the cases.]

$$\text{Given } R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}]$$

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

**Allen Ans. (4)**

**Sol.**

$$K = A e^{\frac{-E_a}{RT}}$$

$$K_{\text{cat}} = A e^{\frac{-E_a}{RT}}, \quad K_{\text{uncat.}} = A e^{\frac{-E_a}{RT}}$$

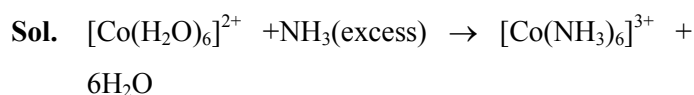
$$\frac{K_{\text{cat}}}{K_{\text{uncat.}}} = e^{\frac{E_a - E_a}{RT}} = e^{\frac{10 \times 1000}{8.31 \times 300}} = e^{4.009} = e^x$$

$$\therefore x = 4$$

9. Reaction of  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  with excess ammonia and in the presence of oxygen results into a diamagnetic product. Number of electrons present in  $t_{2g}$ -orbitals of the product is \_\_\_\_\_.

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

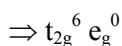
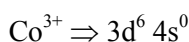
**Allen Ans. (6)**



Diamagnetic



Low spin complex

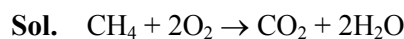


Total number electrons = 6

10. The moles of methane required to produce 81 g of water after complete combustion is \_\_\_\_\_  $\times 10^{-2}$  mol. [nearest integer]

**Official Ans. by NTA (225)**

**Allen Ans. (225)**



POAC on H atom

$$n_{\text{CH}_4} \times 4 = n_{\text{H}_2\text{O}} \times 2$$

$$n_{\text{CH}_4} = \frac{81}{18} \times 2 \times \frac{1}{4} = \frac{81}{36}$$

$$n_{\text{CH}_4} = 2.25$$

$$= 225 \times 10^{-2}$$

Nearest Integers = 225