JEE MAIN 2025

PAPER DISCUSSION

Attempt : 01
Date : 23rd Jan 2025
Shift : 01

LIVE STREAMING

LIVE STREAM

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JEE ULTIMATE CRASH COURSE 2025

Physical Chemistry

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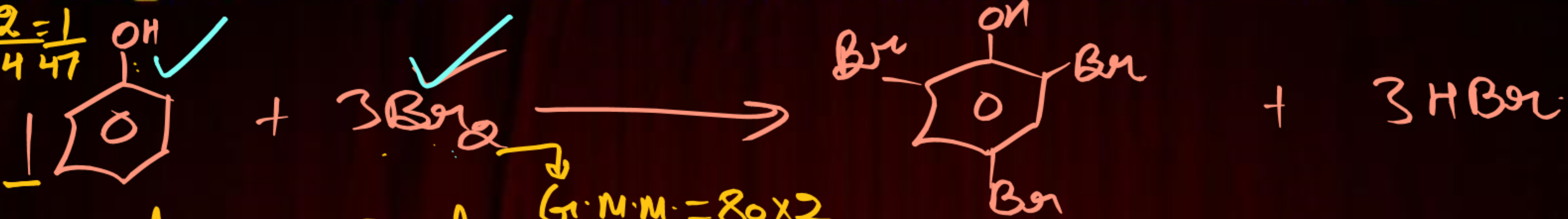
Amount of Br_2 required for formation of 2, 4, 6- tribromophenol from 2 g phenol?

$n_{Phenol} = \frac{2}{94} = \frac{1}{47}$



G.M.M. = 80×2 = 160

1 mole ⟶ 3 mole

$\frac{1}{47}$ mole ⟶ $\frac{3}{47}$ mole

C_6H_5OH

72+6+16=94

mass of $Br_2 = \frac{3}{47} \times 160$

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Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H-atom is suitable for this purpose ?

$Z = 1$

$\lambda = 900\,nm$

(A) Lyman(∞ to 1), ✗

(B) Balmer (∞ to 2) ✗

(C) Paschen (∞ to 3) ✓

$n_1 = 3 \quad n_2 = \infty$

$\rightarrow \bar{\nu} = \frac{RZ^2}{n_1^2} \Rightarrow \lambda = \frac{n_1^2}{RZ^2} = \frac{9}{10^7} = 9 \times 10^{-7}\,m$

$= \frac{900}{100} \times 10^{-7}\,m$

$= 900 \times 10^{-9}\,m$

$= 900\,nm$

(D) Paschen (5 to 3)

Consider the given values:

$\Delta H = 55 \text{ kJ mol}^{-1}$

$\Delta S = 175 \text{ J mol}^{-1} \text{K}^{-1}$

$T = 25°C = 298 K$

Calculate the value of Gibbs free energy charge (ΔG) in J mol^{-1}.

$$\Delta G = \Delta H - T\Delta S$$

$$= 55000 - 298 \times 175$$

$$= 55000 - 51250 = 2850 \text{ J/mol}$$

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$Co(NH_3)_xCl_3$ has 0.1 molal, 100% dissociation $\Delta T_f = 0.558$ ($k_f = 1.86$). Then formula of compound is

(A) $[Co(NH_3)_3Cl_3]$ + H_2O → 0 ions

(B) $[Co(NH_3)_2Cl_4]$ + H_2O → 0 ions

(C) $[Co(NH_3)_5Cl]Cl_2$ + H_2O → $[Co(NH_3)_5Cl]^+ + 2Cl^-$ ✓

(D) None of these

m = 0.1

i = n

$\Delta T_f = 0.558$

$K_f = 1.86$ K/m

$\Delta T_f = i K_f m$

$0.558 = i \times 1.86 \times 0.1$

i = 3 = n

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Consider the following

$$FeO_4^{2-} \xrightarrow{2.0\,V} Fe^{3+} \xrightarrow{0.8\,V} Fe^{2+} \xrightarrow{-0.5\,V} Fe^0$$

Find $E^o_{FeO_4^{2-}/Fe^{2+}}$

① $\overset{+6}{Fe}O_4^{2-} \xrightarrow{+3e^-} Fe^{3+}$ $\quad E_1^0 = 2V$

② $Fe^{3+} \xrightarrow{+1e^-} Fe^{2+}$ $\quad E_2^0 = 0.8V$

$\overset{+6}{Fe}O_4^{2-} \xrightarrow{+4e^-} Fe^{2+}$ — ③

$\Delta G_3^0 = \Delta G_1^0 + \Delta G_2^0$

$-n_3 F E_3^0 = -n_1 F E_1^0 - n_2 F E_2^0$

$4 \times E_3^0 = 3 \times 2 + 1 \times 0.8$

$E_3^0 = \frac{6.8}{4} = \frac{68}{40} = \frac{17}{10}$

$E_3^0 = 1.7\,V$

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Adiabatic constant of a gas is 3/2. If volume of gas initially at 0°C is reduced to one fourth of the original volume then new temperature is:

(A) 0 K

(B) 273 K

(C) 546°C

(D) 546 K ✓

$\gamma = \frac{3}{2}$

$T_1 = 0°C = 273\ K$

$V_1 = V\ L$

$V_2 = \frac{V}{4}\ L$

$T_2 = ?$

$TV^{\gamma-1} = K$

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$

$273 \times (V)^{\frac{3}{2}-1} = T_2 \left(\frac{V}{4}\right)^{\frac{3}{2}-1}$

$T_2 = 273 \times \frac{(4V)^{\frac{1}{2}}}{(V)^{1/2}}$

$= 273 \times \sqrt{4} = 273 \times 2 = 546\ K$

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If 10^{21} molecules are removed from X mg of $CO_2(g)$, then 2.4×10^{-3} moles are left. Calculate the value of x.

x mg

$$\frac{x}{1000 \times 44} - \frac{10^{21}}{6 \times 10^{23}} = 2.4 \times 10^{-3}$$

$$\frac{x}{44000} - \frac{1}{600} = 24 \times 10^{-4}$$

$$\frac{600x - 44000}{44000 \times 600} = 24 \times 10^{-4}$$

$$600x = 24 \times 10^{-4} \times 44000 \times 600 + 44000$$

$$x = \frac{63360 + 44000}{600}$$

$$x = 178.9 \approx 179$$