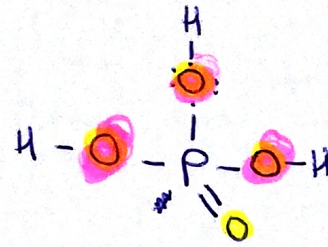
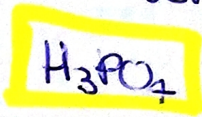


14/12/200

① FORMOLE UEMS



CF<sub>H</sub> = 1 - 1 = 0

CF<sub>O</sub> = 6 - 4 - 2 = 0

CF<sub>P</sub> = 5 - 0 - 5 = 0

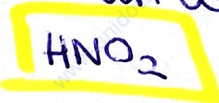
CF<sub>O</sub> = 6 - 4 - 2 = 0

⊗ RETTO ESPANSO (P, S)

e valenza tot

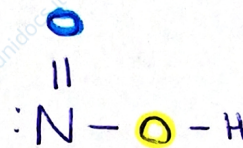
3 · 1 + 5 + 4 · 5 = 23 e valenza

② FORMULA UEMS



CF<sub>N</sub> = 5 - 2 - 3 = 0

CF<sub>O</sub> = 6 - 4 - 2 = 0



CF<sub>O</sub> = 6 - 4 - 2 = 0

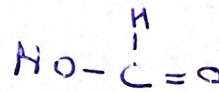
CF<sub>H</sub> = 1 - 1 = 0

e val = 6 · 2 + 1 + 5 = 18 e valenza

③ **CH<sub>3</sub>COOH**

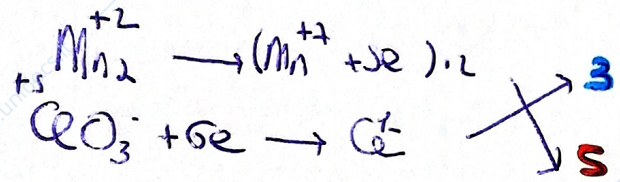
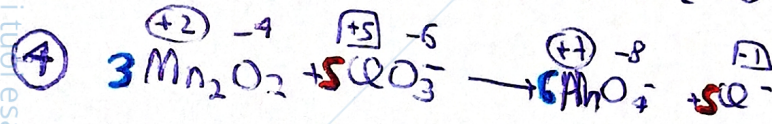
CF<sub>C</sub> = 4 - 4 = 0

CF<sub>O</sub> = 6 - 4 - 2 = 0



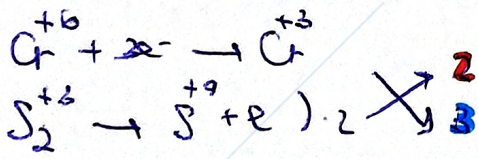
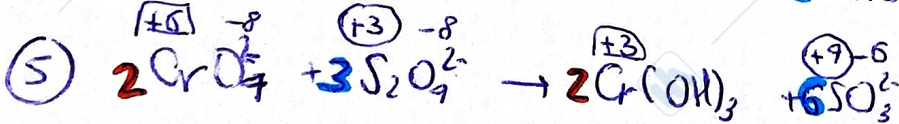
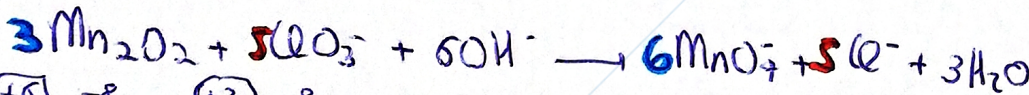
e val = 4 + 12 + 2 = 18 e v

CF<sub>H</sub> = 1 - 1 = 0



BASICO

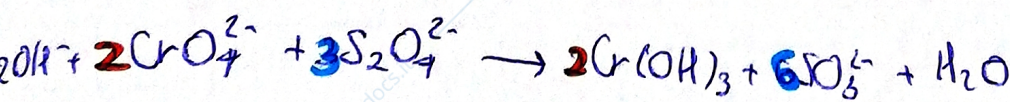
cariche = -5 → -6 - 5 + 6OH<sup>-</sup>



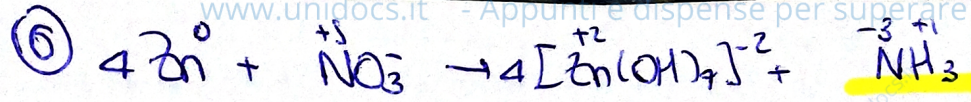
BASICO

CANONE

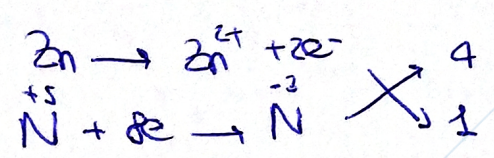
-4 + -6 → -12 + 2OH<sup>-</sup>



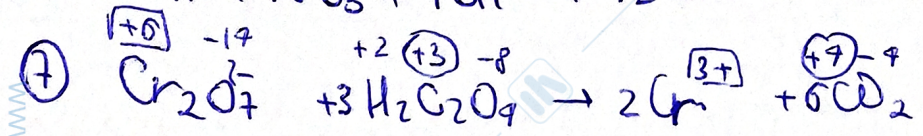
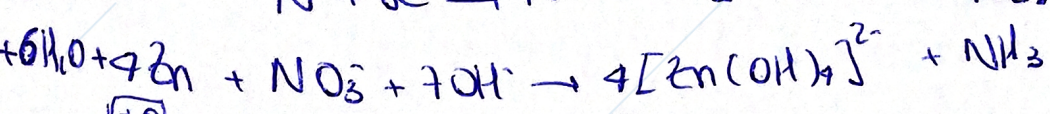
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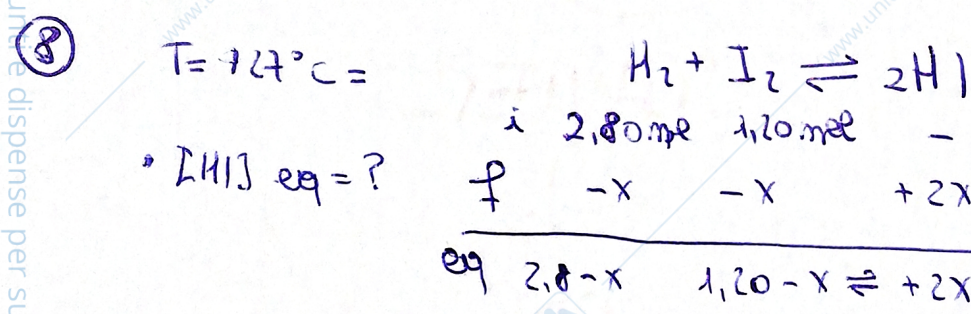
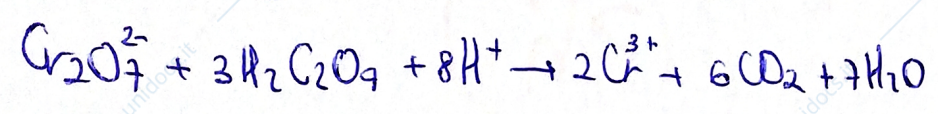
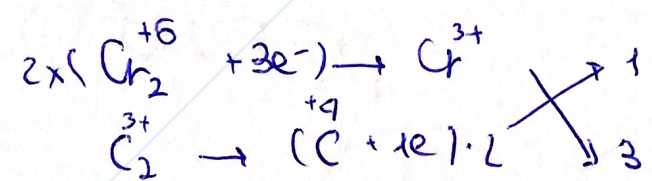
BASICO



cariche:  $-1 \rightarrow -8 + 7OH^-$   
 massa:  $0 = +3 + 7 \rightarrow +816$   
 $+60 \rightarrow 8H_2O$



cariche:  
 $-2 \rightarrow +6 + 8H^+$   
 massa:  $+7H_2O$



$K_c = 55,3$   
 $PM(HI) = 127,91 \text{ g/mol}$   
 $\Delta V = 0$   
 $\rightarrow$  POSSO USARE LE MOLI ANZICHÉ M

$K_c = 55,3 = \frac{(2x)^2}{(2,8-x) \cdot (1,20-x)}$

~~$(154 - 55,3x) \cdot (66,38 - 55,3x) = 4x^2$~~   
 ~~$10219,94 - 3669,71x + 8516,2x - 3057,09x^2 = 4x^2$~~   
 ~~$3057,09x^2 - 12185,91x + 10219,94 = 0$~~

$51,3x^2 - 221,2x + 185,8 = 0 \quad \dots \quad x = 1,14$   
 $[HI] = 2 \cdot 1,14 = 2,28 \text{ mol}$

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11/12/2020

- BISOGNA SAPER  $E_{\text{cell}} = E_{\text{CATODO}} - E_{\text{ANODO}}$
- NEST  $E = E^{\circ} + \frac{0,059}{n} \log \frac{[\text{OX}]}{[\text{RED}]}$   $\Leftrightarrow E = E^{\circ} - \frac{0,059}{n} \log \frac{[\text{RED}]}{[\text{OX}]}$

① Si solubilizzano in  $\text{H}_2\text{O}$  1,5237g  $\text{MgCl}_2$

$V_{\text{tot}} = 250 \text{ mL}$   $\rightarrow$  qui immersa lamina di Mg puro

$\Rightarrow$  VALORE dell' ELETTRODO ?

$$E^{\circ}(\text{Mg}^{2+}/\text{Mg}) = -2,372 \text{ V}$$

$$PM \text{ MgCl}_2 = 95,21 \text{ g/mol}$$

TROVO moli  $\text{MgCl}_2 \rightarrow m(\text{MgCl}_2) = \frac{m(\text{g})}{PM(\text{g/mol})} = 1,6 \cdot 10^{-2} \text{ mol}$

SAPPIAMO CHE  $\text{MgCl}_2$  è COMPLETAMENTE DISSOCIATO

$$M = \frac{m(\text{MgCl}_2)}{V_{\text{tot}}} = \frac{1,6 \cdot 10^{-2} \text{ mol}}{0,25 \text{ L}} = 6,4 \cdot 10^{-2} \text{ mol/L}$$

$$\rightarrow [\text{MgCl}_2^{\text{aq}}]$$

NEST:  $E = E^{\circ} - \frac{0,059}{n} \cdot \log \frac{[\text{OX}]}{[\text{RED}]}$

(METTO SEMPRE LA FORMULA BASE)

$$E = -2,372 \text{ V} - \frac{0,059}{2} \cdot \log \frac{[6,4 \cdot 10^{-2}]}{1} = -2,407 \text{ V}$$

- SOLIDI e LIQUIDI CONCENTRAZIONE = 1  $\rightarrow$  LA LORO CONCENT. NON VARIA
- GAS CONCENTRAZIONE =  $P(\text{atm})$

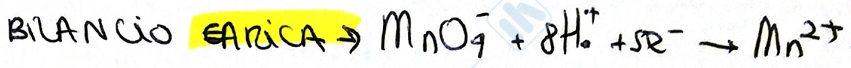
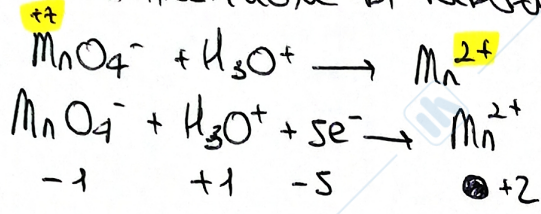
② LAMA Pt IMMERSA IN SOLUZIONE A pH = 1  $[Mn^{2+}] = 0,2M$

$[MnO_4^-] = 0,1M$

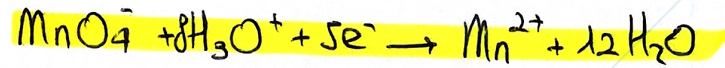
TROVO POTENZIALE ELETTRICO

$E^{\circ}(MnO_4^-/H_3O^+/Mn^{2+}) = 1,507V$

- SCRIVO SEMIREAZIONE DI RIDUZIONE



BILANCIO MASSA



$E = E^{\circ} + \frac{0,059}{n \text{ elettr}} \cdot \log \frac{[OX]}{[RED]} \Rightarrow E = 1,507V + \frac{0,059}{5} \cdot \log \frac{[MnO_4^-] \cdot [H_3O^+]^8}{[Mn^{2+}]}$

$E = 1,507V + \frac{0,059}{5} \cdot \log \frac{[0,1] \cdot [10^{-8}]^8}{[0,2]} = 1,409V$

③ Pt V=0,5L  $\rightarrow$  sol  $[SnCl_2] = 10^{-1}M$   
 $[SnCl_4] = 4 \cdot 10^{-2}M$

$E_1 = ?$   
 $E_2 = ?$

$\rightarrow +5,309g$  di  $SnCl_2$

$E^{\circ}(Sn^{4+}/Sn^{2+}) = 0,151V$   
 $PM(SnCl_2) = 189,60 g/mol$

- NEST  $E = E_0 + \frac{0,059}{n e^-} \cdot \log \frac{[OX]}{[RED]}$

$E(Sn^{4+}/Sn^{2+}) = 0,151V + \frac{0,059}{2} \cdot \log \frac{[Sn^{4+}]}{[Sn^{2+}]}$

$E = 0,151V \cdot \frac{0,059}{2} \cdot \log \frac{[4 \cdot 10^{-2}]}{[10^{-1}]} = 0,134V$

④  $Fe^{3+}/Fe^{2+}$   $[Fe^{3+}] = 10^{-2} M$   $[Fe^{2+}] = 0,16 M$   
 $Mn^{2+}/Mn$   $[Mn^{2+}] = 8 \cdot 10^{-2} M$   
 $f_{em} = ?$   $E^\circ(Fe^{3+}/Fe^{2+}) = 0,771 V$   $E^\circ(Mn^{2+}/Mn) = -1,185 V$

- NEXT ALLE 2 SEMICELLE  $\rightarrow f_{em} = E_c - E_A$

$Fe^{3+}/Fe^{2+} \rightarrow E = E^\circ + \frac{0,059}{n} \cdot \log \frac{[Ox]}{[Red]}$   
 $E = 0,771 V + \frac{0,059}{1} \cdot \log \frac{[10^{-2}]}{[0,16]} = 0,700 V$

$Mn^{2+}/Mn \rightarrow E = -1,185 V + \frac{0,059}{2} \cdot \log \frac{[8 \cdot 10^{-2}]}{1} = -1,217 V$   
 1/2 solido!

CALCOLO  $f_{em} = E_{CATODO} - E_{ANODO}$

CHI È IL CATODO? CHI L'ANODO?  $\rightarrow$  COPPIA CON POTENZIALE MAGGIORE È LA COPPIA OSSIDANTE QUINDI ESSA SI RIDURRA!

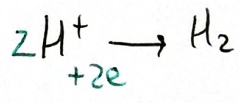
$E(Fe^{3+}/Fe^{2+})$  si RIDUCE  $\rightarrow$  CATODO  
 $E(Mn^{2+}/Mn)$  si OSSIDA  $\rightarrow$  ANODO  
 $f_{em} = 0,700 V + 1,217 V = 1,917 V$

⑤  $f_{em} PIA = 0,196 V$   
 $(Pt)/H_2(g)$   $p = 1 atm$  /  $H_3O^+ 1 M$  |  $H_3O^+ 0,5 M$  /  $H_2(g)$   $P = 1 atm$   $Pt(+)$

TROVO  $[H_3O^+] = ?$  ANODO

$E(H_3O^+/H_2) = 0,00 V$

NEXT CATODO  
 $E_c \Rightarrow E^\circ(H_3O^+/H_2) + \frac{0,059}{n} \cdot \log \frac{[Ox]}{[Red]}$   
 $E = E^\circ(H_3O^+/H_2) + \frac{0,059}{2} \cdot \log \frac{[H_3O^+]^2}{P(H_2)}$   
 $E_c = \frac{0,059}{2} \cdot \log \frac{[0,5]^2}{1 atm} = -0,018 V$



-  $f_{em} = E_c - E_A$   $E_A = -(f_{em} + E_c) = -0,214 V$

- NEXT ANODO  
 $E_A = E^\circ(H_3O^+/H_2) + \frac{0,059}{2} \cdot \log \frac{[Ox]}{[Red]}$

$-0,214 V = 0 + \frac{0,059}{2} \cdot \log \frac{X^2}{1}$

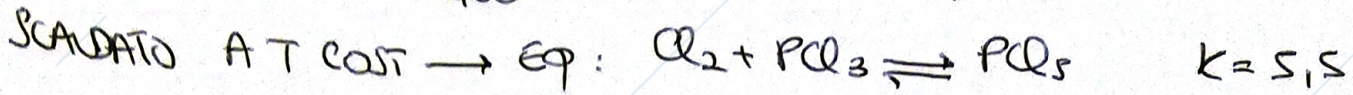
$\log X^2 = \frac{-0,214 \cdot 2}{0,059}$   $X^2 = 10^{-7,25}$   $\rightarrow X = 2,36 \cdot 10^{-4} M = [H_3O^+]$

# Esercitazione del 16/12/2020

## 1) Equilibrio chimico

$$V = 20L$$

$$2,00 \text{ mol } Cl_2 \quad 4,00 \text{ mol } PCl_3$$



quante moli di  $PCl_5$  all'eq?

CANVA i.c.e

	$Cl_2$	$PCl_3$	$\rightleftharpoons$	$PCl_5$
p.i.	2	4		-
p.x	x	x		x
p.eq	2-x	4-x		+x

$$K = \frac{[PCl_5]}{[Cl_2] \cdot [PCl_3]} = 5,5$$

$$[PCl_5] = \frac{x}{20L} \quad [Cl_2] = \frac{(2-x)}{20L}$$

$$[PCl_3] = \frac{(4-x)}{20L}$$

$$K = 5,5 = \frac{20L \cdot x}{(2,00-x) \cdot (4,00-x)} \Rightarrow \frac{5,5 \pm \sqrt{5,5^2 - 4 \cdot 5,5 \cdot 4}}{2,55} \rightarrow 8,72 \text{ (*)}$$

**0,92**

VALORE TROPPO ALTO!

ADDIZIONE 8 moli di  $Cl_2 \rightarrow$  TROVO moli  $PCl_5$

	$Cl_2$	$PCl_3$	$\rightleftharpoons$	$PCl_5$
p.eq <sub>1</sub>	1,08	3,08		0,92
p.variaz	9,08	3,08		0,92
p.eq <sub>2</sub>	9,08-x	3,08-x		0,92+x

$$K = 5,5$$

$$K = \frac{(0,92+x)}{(9,08-x)(3,08-x)}$$

$$K = \frac{(0,92+x) \cdot 20L}{(9,08-x) \cdot (3,08-x)}$$

$$5,5x^2 - 86,88x + 135,42 = 0$$

$$x = 1,75 \text{ mol}$$

$$PCl_5 = 0,92 + 1,75 = \mathbf{2,67 \text{ mol}}$$

l'equilibrio si sposta A DX

②

Cu	74,5 g	193°C	$C_{Cu} = 0,385 \text{ J/g}^\circ\text{C}$
Gly	165 mL e $d = 1,26 \text{ g/mL}$	24,8°C	$C_{Gly} = ?$ $T_F = 31,1^\circ\text{C}$

$-q_{Cu} = q_{Gly}$  (- → CEDE CALORE, + → ACQUISTA CALORE)

$Q = m \cdot C \cdot \Delta T$

→ SPOSTAMENTO DI CALORE DA CONTO CALPO → FINIRÒ PURA FINO A

$T_{Cu} = T_{Gly} = 31,1^\circ\text{C}$

$-q_{Cu} = q_{Gly}$

$(74,5 \text{ g} \cdot 0,385 \text{ J/g}^\circ\text{C} \cdot (111,9^\circ\text{C})) = 207,9 \text{ g} \cdot C_{Gly} \cdot 6,3^\circ\text{C}$

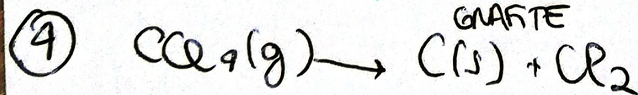
$m(\text{g}) = 165 \text{ mL} \cdot \frac{1,26 \text{ g}}{\text{mL}} = 207,9 \text{ g}$

$C_{Gly} = \frac{74,5 \text{ g} \cdot 0,385 \text{ J/g}^\circ\text{C} \cdot 111,9^\circ\text{C}}{207,9 \text{ g} \cdot 6,3^\circ\text{C}} = 2,45 \text{ J/g}^\circ\text{C}$

③  $T_i = 20,5^\circ\text{C}$  250 mL CAFFÈ  $q = ?$   
 $T_f = 95,6^\circ\text{C}$   $d = 1,00 \text{ g/mL}$   $C = 4,184 \text{ J/g}^\circ\text{C}$

$q = m \cdot C \cdot \Delta T = 250 \text{ g} \cdot 4,184 \text{ J/g}^\circ\text{C} = 75,1 \text{ k} = 7855 \text{ J}$

$250 \text{ mL} \cdot \frac{1 \text{ g}}{\text{mL}} = 250 \text{ g}$



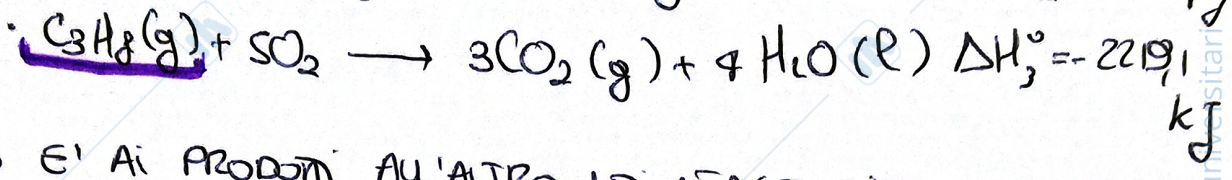
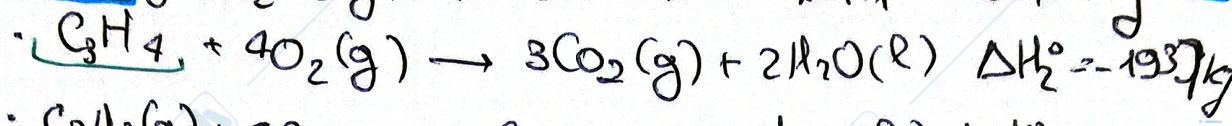
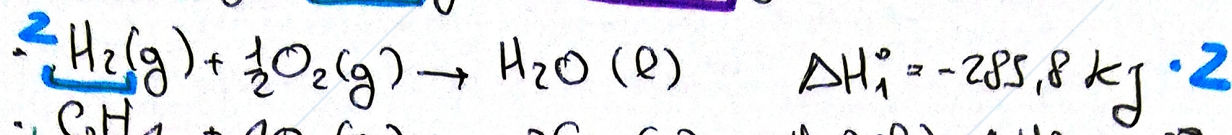
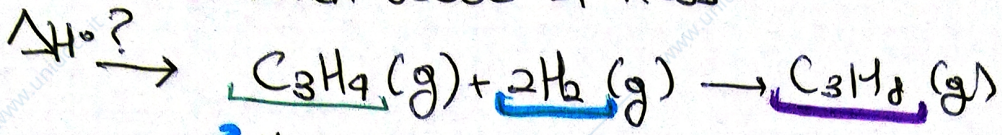
$\Delta H = 95,7 \text{ kJ} = 95,7 \cdot 10^3 \text{ J}$   
 $\Delta S = 142 \text{ J/K}$

$\Delta G$  a  $298^\circ\text{K}$   
 e' SPONTANEA?

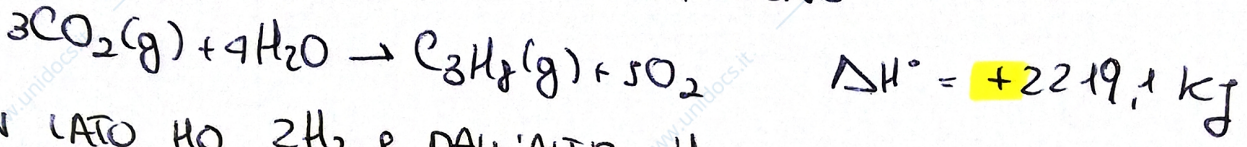
$\Delta G = \Delta H - \Delta S \cdot T = 9,5 \cdot 10^4 \text{ J} - 298 \text{ K} \cdot 142 \text{ J/K} \geq 0$

NON e' SPONTANEA

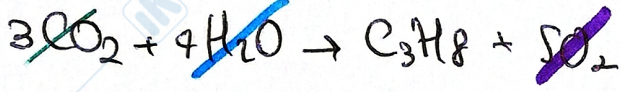
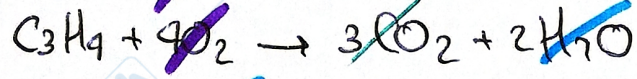
5) APPLICAZIONE DELLA LEGGE DI HESS



• DA UN LATO E' AI PRODOTTI ALL'ALTRO NEI REAGENTI  
 => REAZIONE INVERSA ->  $\Delta H$  CAMBIA SEGNO



DA UN LATO HO  $2H_2$  e DAU'ALTRO  $H_2$   
 =>  $\times 2 \rightarrow \Delta H \times 2$

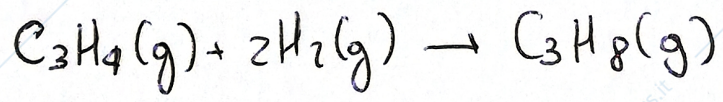


$\Delta H = -571,6 \text{ kJ}$

$\Delta H_1 = -571,6 \text{ kJ}$

$\Delta H_2 = -1937 \text{ kJ}$

$\Delta H_3 = 2219,1 \text{ kJ}$



$\Delta H_{TOT} = \Delta H_1 + \Delta H_2 + \Delta H_3 = -289,5 \text{ kJ}$

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