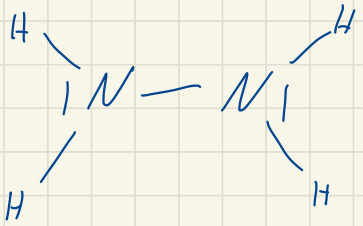
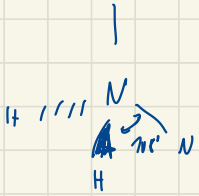
1.



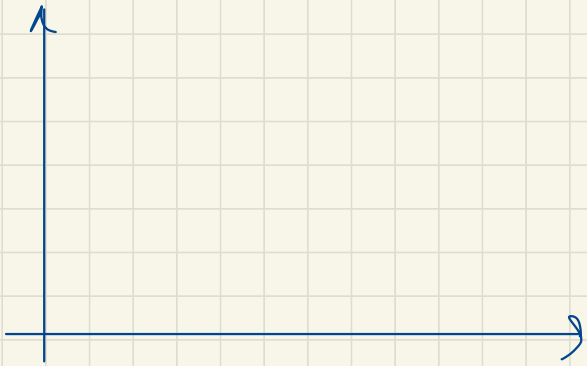
$d(N-N) \simeq 10^{-10}$ m

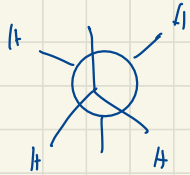
2.



AX_3E_1 Pyramidale à base triangulaire

$\alpha = 108°$





4. $ClO^- + NH_3 = Cl-NH_2 + HO^-$

$ClO^- + Cl-NH_2 + NH_3 = N_2H_4 + H_2O + Cl^-$

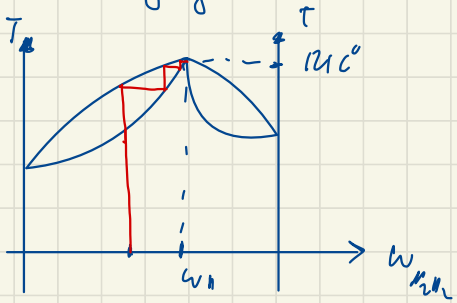
$30\ m_{NaClO} = m_{NH_3}$ et $m_{produit} = m_{NaClO}$

donc $EMR = \dfrac{m_p \cdot (14\times2+4)}{m_0 \cdot (35{,}5+16) + 30 m_0 \cdot (14+3)}$ $\quad m_p = 0{,}6\, m_0$

$= 0{,}6 \cdot \dfrac{14\times2+4}{(35{,}5+16) + 30\cdot(14+3)} = \boxed{3{,}4\% = EMR}$

6. Formation de liaisons hydrogènes

7.



$\omega = \dfrac{n_{N_2H_4}}{n_{H_2O} + n_{N_2H_4}} = \dfrac{14\times2+2}{18+30} = \dfrac{30}{(18+30)} = 0{,}63$ du mieux

9. $|H_2O\ N_2H_2|$

10 : 1 : liquide $H_2O_{(l)} + N_2H_4{}_{(l)}$ pur miscible

2 : 2φ : $N_2H_{2(s)}$, $H_2O_{(l)} + H_2N_2{}_{(l)}$

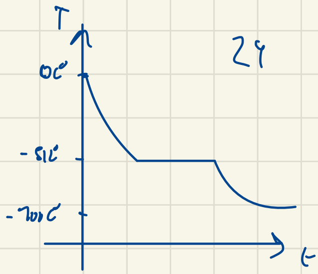
3 : 2φ : $N_2H_{2(s)} + (N_2H_4H_2O)$,

4 : 2φ : $(N_2H_2H_2O)_{(s)}$, $N_2H_4 + H_2O_{(l)}$

5 : "

6 : $H_2O_{(s)}$ et $H_2O_{(s)} + N_2H_4{}_{(l)}$

11. $T_{éb} = -51\,C$



$x^l_{H_2O}$, $x^l_{N_2H_4}$, P, T.

$x^l_{H_2O} + x^l_{N_2H_4} = 1$, $H_2O_l + N_2H_4{}_l = N_2H_4H_2O_{(s)}$

donc $x^l_{H_2O} = x^l_{N_2H_4}$

3 rel', 4 p : $\underline{V = 1}$, P fixé, $\underline{V = 0}$

12. réaction de formation du composé avec les réactifs pris dans leur état standard de référence ($\nu_{produit} = 1$)

13.

$$N_{2(g)} + 2H_{2(g)} \xrightarrow{\Delta_r H^\circ} N_2H_{4(l)}$$

$\downarrow \Delta_r H^\circ = D_{N\equiv N} + 2D_{H-H}$; $\uparrow -\Delta_{vap}$

$$2N_{(g)} + 4H_{(g)} \xrightarrow{D_{N-N} + 4D_{N-H}} N_2H_{4(g)}$$

$-\Delta_r H^\circ = 947 + 2\times 436$

$- 159 - 4\times 390 - 44{,}7 = 50{,}3\ kJ.mol^{-1}$

On a bien $\Delta_r H^\circ = -50{,}3\ kJ.mol^{-1} < 0$, la réaction est exothermique

14. Loi de Hess : $\Delta_r S^\circ = 2\Delta_f S^\circ H_2 + \Delta_f S^\circ N_2 - \Delta_f S^\circ N_2H_{4(l)}$

AN : $\Delta_r S^\circ = 2\cdot 130 + 191 - 121 = 330\ J.K^{-1}.mol^{-1} > 0$

l'entropie augmente car $\Delta_{vap} S > 0$; entropiquement favorable.

15 $\Delta_r G^\circ = \Delta_r H^\circ - T\Delta_r S^\circ$

AN $\Delta_r G^\circ = -50 - 300\cdot 0{,}3$

$= -149\ kJ.mol^{-1}$

16. Donc $K^\circ = \exp\left(-\frac{\Delta_r G^\circ}{RT}\right) = 10^{26} \gg 1$

Composé très combustible qui se dissout naturellement en N_2, H_2

quantitativement

17. $K^\circ \sim 10^{26}$

18. $E = \Delta_r H^\circ \cdot n$

donc $n = \frac{E}{\Delta_r H^\circ}$ or $V = \frac{m \cdot n}{\rho}$

donc $V = \frac{n E}{\Delta_r H^\circ \rho}$

AN: $V = \frac{10^8 \cdot (2 \times 14 + 4) \cdot 10^3}{50 \cdot 10^3 \cdot 1}$

AN $V = 64\ L$

19. Cinétique: prévoir la durée des réactions

+ info sur les mécanismes réactionnels.

20. $v = \frac{d\xi}{dt} = -\frac{1}{\alpha}\frac{d[NH_3]}{dt}$

$= \frac{1}{\beta}\frac{d[O_2]}{dt}$

donc $\beta \frac{d[NH_3]}{dt} = \alpha \frac{d[O_2]}{dt}$

$\frac{[NH_3]_1 - [NH_3]_2}{[O_2]_1 - [O_2]_2} = \frac{\alpha}{\beta}$

$\Rightarrow \beta [NH_3] = \alpha [O_2] + cste$

$[NH_3] = \frac{\alpha}{\beta}[O_2] + cste$ $\Rightarrow \frac{7,91 - 6,80}{3,25 - 3,09} = 0,97$

$\begin{cases} \alpha = 1 \\ \beta = 2 \end{cases}$

22. $v = k [O_2]^{\alpha} [NH_3]^{\beta}$

23. O_2 en excès : $v = k_{app} [O_2]^{\alpha}$

24 $\ln [v(t=0)] = L + q [O_2]_0$

$q = \alpha$

25.

26. $v = k [O_2] [NH_3]$

$v(t=0) = -\frac{1}{2} \frac{d[O_2]}{dt} = \frac{1}{2} \cdot 0{,}25 \cdot 10^{-6}$

$k = \frac{v(t=0)}{[O_2]_0 [NH_3]_0}$ AN : $k = \frac{\frac{1}{2} \cdot 0{,}25 \cdot 10^{-6}}{5 \cdot 10^{-3} \cdot 0{,}25 \cdot 10^{-3}}$

$= 1{,}6 \text{ L} \cdot \text{mol}^{-1} \cdot \text{min}^{-1}$

$k = A \cdot e^{-E_a / RT}$ $\ln k = C - E_a / RT$

$n \ln \frac{k}{k'} = -E_a \left(\frac{1}{T} - \frac{1}{T'} \right)$

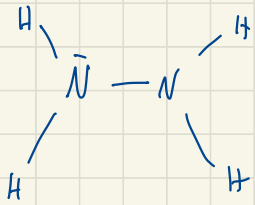
AN $E_a = \dots$

28. $\beta \neq q \Rightarrow$ ce n'est pas un acte élémentaire

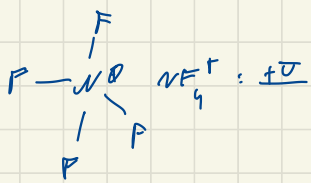
29. $v_1 = k_1 [NH][O_2]$

$= v_2 = v_3 = k_3 [Y][O_2]$

$\frac{d[O_2]}{dt} = v_1 + v_3 = 2k_1[NH][O_2]$

30. 

$\rightarrow |\underline{\overline{N}}^{\oplus}| : -\underline{III}$

31. $|\underline{\overline{N}}| : -\underline{III}$ NH_3  $NF_4^+ : +\underline{V}$

32. $N_2H_5^+ : B$ $N_2 : A$

$N_2H_4 : C$

33. $pH = pK_a : 8 = pK_a (N_2H_5^+ / N_2H_4)$

34. $N_2H_5^+ = N_2 + 5H^+ + 4e^-$

$E = E^\circ + \frac{0,06}{4} \cdot \log \left(\frac{[H^+]^5 \cdot P_{N_2}}{C^\circ [N_2H_5^+] P^\circ} \right)$

$= C - \frac{0,15}{2} pH$ $\rho = 0,075$

35. $E = E^\circ + \frac{0,06}{4} \log \left(\frac{1}{[N_2H_5^+]} \right)$

$$0{,}03 = \frac{0{,}06}{4} \log\left(\frac{1}{[N_2H_5^+]}\right)$$

$$\Rightarrow \boxed{[N_2H_5^+] = 10^{-2}\ mol\cdot L^{-1}}$$

36. $A_{(g)} = A_{(aq)}$ $\quad K_c = \frac{[A]}{P_A} = \frac{[A]}{C^\circ}$

$O_{2(g)} = O_{2(aq)}$ $\quad K^\circ = \frac{[O_2]}{P_{O_2}} \frac{P^\circ}{C^\circ}$

$[O_2] = \frac{s}{n} = \frac{1{,}25 \cdot 10^{-3}}{2 \times 1{,}6}$

$P_{O_2} = 0{,}2\ bar$

$K^\circ = \frac{1{,}25 \cdot 10^{-3}}{2 \times 1{,}6 \cdot 0{,}2}$ $\quad AN : K^\circ =$

5 : qté max de gaz dans 1L d'eau.

37. $O_{2(aq)} + 4H^+_{(aq)} + 4e^- = 2H_2O_{(l)}$ $\quad \Delta_r G^\circ = -4FE^\circ_{aq}$

$O_{2(g)} + 4H^+ + 4e^- = 2H_2O$ $\quad = -4FE^\circ_g$

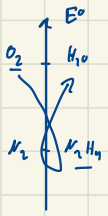
$O_{2(g)} = O_{2(aq)}$ $\quad \Delta_{tr} G^\circ = -RT \ln K^\circ$

$\Leftrightarrow -4FE^\circ_{aq} - RT \ln K^\circ = -4FE^\circ_g$

donc $E^\circ_g = E^\circ_{aq} + \frac{RT}{4F} \ln K^\circ$

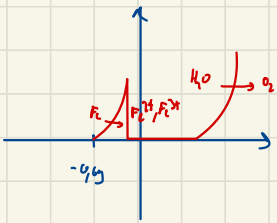
$$\boxed{E^\circ_g = E^\circ_{aq} + \frac{0{,}06}{n} \log K^\circ}$$

38.



39. adhérent et imperméable

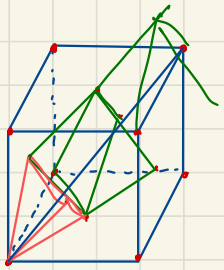
40.



$E_{f_2} = E^\circ - E_{ass} + \eta_A$

$= 1{,}3\,V$

41.



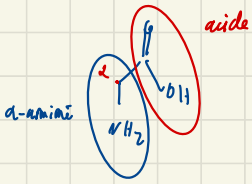
$\frac{12}{4} + 1 = 4$ sites actifs

$2n_+ + 2n_{O^-} = 4$

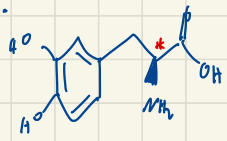
donc $n_+ = \frac{4}{2} - n_{O^-}$

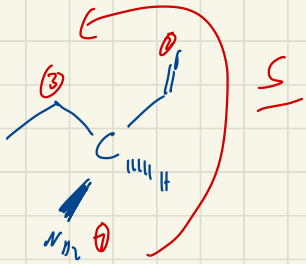
$\frac{a\sqrt{3}}{4} = n_+$

44.



45.

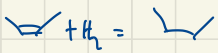




46. (+) lévogyre (-) dextrogyre

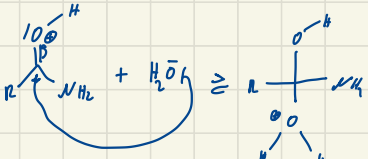
(±) mélange racémique

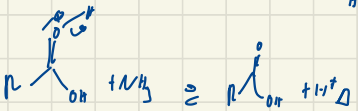
48. $2H_2O = 2H_2 + O_2$



51. Grâce à $C \equiv N$ caractéristique et déplacé $C=O$

52.

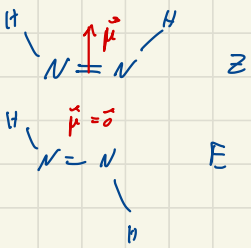




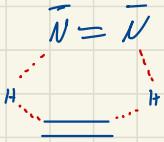
$H^+O + N_3 = NH_4^+$

56. $R_n OCH_3 + HBr = CH_3Br + R_nOH$

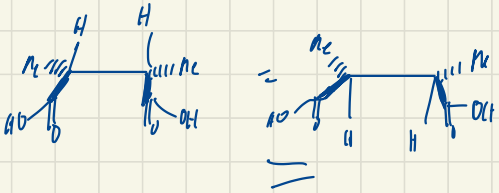
61.



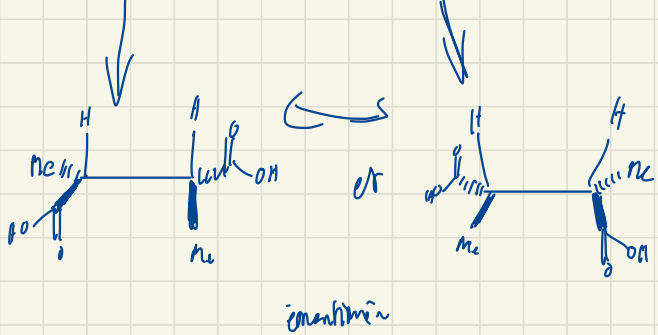
63.



64.



diastéréoisomères



énantiomère

65. Nom énantiomère spécifique

66. $\frac{V - V_0}{V_0} \cdot 10^6$

67. Liaison chimique entre un hétéroatome (N, F, O ...)

69. eV : 4 x 2 + 10 - 2 = 16 eV

69 : acide moins oxydant

a : acide oxydant

1 : 1/2 réaction