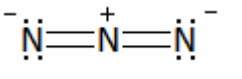
Problema 4 Magnesium compounds

a) i) $2\ Mg_{(s)} + O_{2(g)} \rightarrow 2\ MgO_{(s)}$
ii) $2\ Mg_{(s)} + CO_{2(g)} \rightarrow 2\ MgO_{(s)} + C_{(s)}$

b) i) $Mg_{(s)} + 2\ H_2O_{(l)} \rightarrow 2\ Mg(OH)_{2(s)} + H_{2(g)}$
ii) $MgO_{(s)} + H_2O_{(l)} \rightarrow 2\ Mg(OH)_{2(s)}$

c) A=Mg_3N_2 B=NH_3 C=N_2H_4 D=$NaNH_2$ E=NaN_3
A) $3\ Mg_{(s)} + N_{2(g)} \rightarrow Mg_3N_{2(s)}$
B) $Mg_3N_{2(s)} + 6\ H_2O_{(l)} \rightarrow 2\ NH_{3(g)} + 3\ Mg(OH)_{2(aq)}$
C) $2\ NH_{3(g)} + ClO^-_{(aq)} \rightarrow Cl^-_{(aq)} + N_2H_{4(aq)} + H_2O_{(l)}$
$2\ NH_{3(g)} + H_2O_{2(aq)} \rightarrow N_2H_{4(aq)} + 2\ H_2O_{(l)}$
D) $2\ NH_{3(g)} + 2\ Na_{(s)} \rightarrow 2\ NaNH_{2(s)} + H_{2(g)}$
E) $2\ NaNH_{2(s)} + N_2O_{(g)} \rightarrow NH_{3(g)} + NaOH_{(s)} + NaN_{3(s)}$
$2\ NaN_{3(s)} \rightarrow 2\ Na_{(s)} + 3N_{2(g)}$

d) 

e) $3\ N_2H_{4(l)} \rightarrow N_{2(g)} + 4\ NH_{3(g)}$

f) $3\ N_2H_{4(l)} \rightarrow 3\ N_2H_{4(g)} \rightarrow N_{2(g)} + 4\ NH_{3(g)}$
$\Delta E°_{reaz.}$ = ((3·95,4 - 3·50,6)+(12·389 + 3·163 - (946 + 12·389))) kJ/mol = - 322,6 kJ/mol

Usando la legge di Hess

$3/4\ N_{2(g)} + 3/2\ H_{2(g)} \rightarrow 3/4\ N_2H_{4(l)}$	$\Delta H_1 = 3/4\ \Delta H°_{f,\ idrazina}$
$3/4\ N_2H_{4(l)} \rightarrow 1/4\ N_{2(g)} + NH_{3(g)}$	$\Delta H_2 = 1/4\ \Delta E°_{reaz.}$
$1/2\ N_{2(g)} + 3/2\ H_{2(g)} \rightarrow NH_{3(g)}$	$\Delta H°_{f,\ ammoniaca} = \Delta H_1 + \Delta H_2 = -42,7$ kJ/mol

g) $$n_{N_2H_4} = \frac{V_{N_2H_4} \cdot d_{N_2H_4}}{MM_{N_2H_4}} = \frac{2{,}00mL \cdot 1{,}0045\frac{g}{mL}}{32{,}052\frac{g}{mol}} = 0{,}0627mol$$

$$n_{tot} = \frac{5}{3} n_{N_2H_4} = 0{,}1044mol$$

$$p = \frac{n_{tot} \cdot R \cdot T}{V} = \frac{0{,}1044mol \cdot 8{,}314\frac{J}{mol \cdot K} \cdot 298K}{1{,}00 \cdot 10^{-3} m^3} = 2{,}59 \cdot 10^5 Pa = 2{,}55atm$$

h) $$w_{isoterma} = -n_{tot} \cdot R \cdot T \cdot \ln\frac{p_i}{p_f} = -0{,}1044mol \cdot 8{,}314\frac{J}{mol \cdot K} \cdot 298K \cdot \ln\frac{2{,}55atm}{1atm} = -242J$$

Soluzione proposta da
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