Problem 1

(a): towards ~~reactants~~ products — Le Chatelier's principle

(b): towards ~~reactants~~ — neither, the partial pressure of neither changed

(c): towards products — since volume is decreasing we want more moles to fill up the space

(d): towards reactant — providing cool to an endothermic reaction causes it to shift in the opposite direction

Problem 2

(a): ~~positive~~ Negative, energy leaves the system when stronger bonds are formed

(b): positive; consider $\Delta G = \Delta H - T\Delta S \rightarrow$ high T causes $\Delta G < 0 \rightarrow \Delta H > 0$.

(c): ~~positive~~ Negative, the reaction is endothermic at first and thus has $\Delta H < 0$.

Problem 3

(a) Sum the reactions

$CO(g) \rightarrow C(graph.) + 1/2\ O_2(g)$ $\Delta H^\circ = +110.54\ kJ$

$C(graph.) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^\circ = -393.51\ kJ$

to get

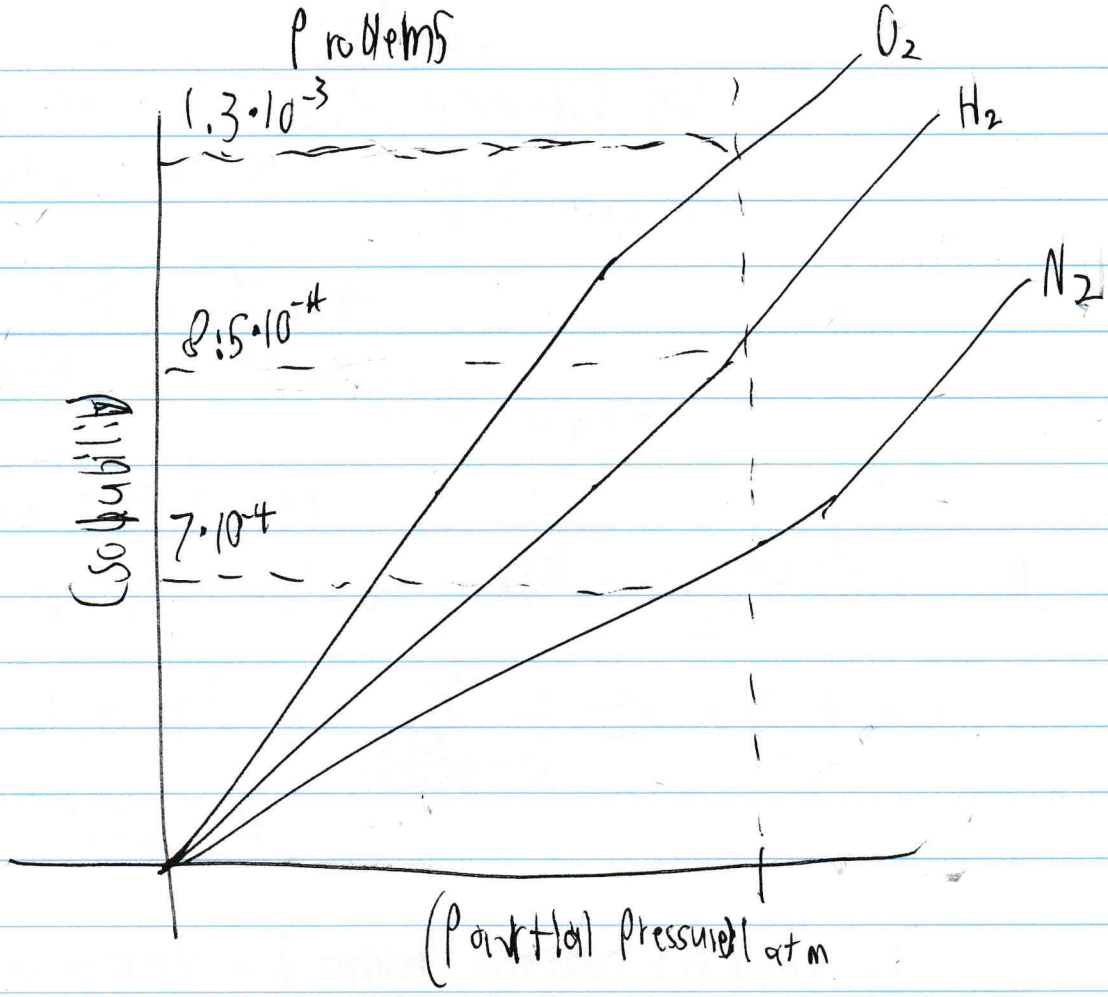
$\Delta H^\circ = -282.97$

(b) Stable due to positive ΔG

Problem 4

Molecule 3 due to CO and NH bonds.

Problems


O_2
H_2
N_2
$1.3 \cdot 10^{-3}$
$8.5 \cdot 10^{-4}$
$7 \cdot 10^{-4}$
(Solubility)
(Partial Pressure) atm

Problem 6

(a): Our 50 ml of 0.1 M weak acid has

$$\frac{0.1 \text{ moles}}{1 \text{ L}} \cdot 50 \text{ ml} = 0.5 \text{ moles acid}$$

and the base eliminates

$$\frac{0.1 \text{ moles}}{1 \text{ L}} \cdot 20 \text{ ml} = 0.2 \text{ moles}$$

Thus, for the reaction

$$CH_3COOH + H_2O \rightarrow [illegible] + H_3O^+ + CH_3COO^-$$

$$K_a = 1.8 \cdot 10^{-5} = \frac{x^2}{\left(\frac{0.3}{0.05} - x\right)} \Rightarrow x \approx 8.78 \cdot 10^{-3}$$

and thus $pH = 2.056$

(b): By a named equation I cannot remember the name of,

$$pH = 4.74$$

(c): 90 mL

(d):

$$K_b = \frac{1 \cdot 10^{-14}}{1.8 \cdot 10^{-5}} = \frac{x^2}{(0.105 - x)} \Rightarrow x = 5.27 \cdot 10^{-6}$$

$$\Rightarrow pH = 8.72$$

Problem 7

Molecule 3