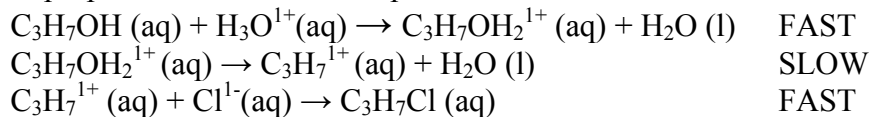


Show your work for all problems and be sure to box your final answer and include sensible units.
No work (i.e., reasonable justification) = no credit.

1. (8 pts) A proposed mechanism for a particular reaction is:



- a. (2 pts) Write the overall, balanced reaction for this reaction.
- b. (6 pts) Write the expected rate law if this proposed mechanism is correct.
2. (12 pts) A sample of a certain monoprotic weak base was dissolved in water and titrated with 0.225 M HNO₃ in the presence of methyl red. After the addition of 6.00 mL of HNO₃, the resulting pH of the yellow solution was 7.108; after the addition of 22.00 mL of HNO₃, the solution took on a slight red color. Calculate the K_b of this weak base.

3. (24 pts) $2 \text{NOBr (g)} \leftrightarrow 2 \text{NO (g)} + \text{Br}_2 \text{(g)}$; at 298 K, the equilibrium constant, K_p , is 9.17×10^{-3} .

a. (8 pts) If the temperature in the container is lowered to 100 K and the overall pressure is observed to increase, what can be said about the enthalpy of this reaction? Briefly explain.

b. (8 pts) If the volume of the container were increased, how would the equilibrium position shift? Briefly explain.

c. (8 pts) If the equilibrium partial pressure of NO is 0.0459 atm and that of NOBr is 0.0468 atm, calculate the partial pressure of Br_2 at equilibrium.

4. (16 pts) Given the following solubility-product constants measured at 25°C.

BeSO_4	1.2×10^{-7}
NH_4SO_4	6.1×10^{-3}
$\text{Fe}_2(\text{SO}_4)_3$	3.7×10^{-6}

a. (4 pts) Rank the solids in order from least to most soluble:

_____ < _____ < _____

b. (12 pts) If saturated solutions are created of each of the above solids, which will have the lowest concentration of hydroxide ions?