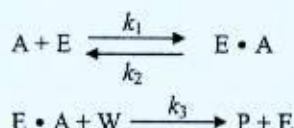


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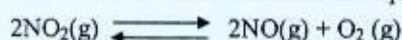
1. Explain the following terms: (A) Hydrogen Bonds (3 points) (B) Critical Pressure (3 points)
(C) Chemical Equilibrium (3 points) (D) Activation Energy (3 points) (E) Ideal Solution (3 points)

2. The mechanism of a reaction $A + W \longrightarrow P$ catalyzed by a homogenous catalyst E in aqueous solution is as following:



Use the assumption that the concentration of EA complex is nearly constant throughout the reaction to find the rate expression ($-r_A$) of the reaction in terms of reactant A, W, and total catalyst concentration Et. (Note: $[Et] = [E] + [EA]$) (10 points)

3. Starting with pure $NO_2(g)$ at a pressure of 0.5 atm, the following reaction come to equilibrium, and the total pressure was 0.674 atm. Calculate the equilibrium partial pressure of NO_2 . (9 points)



4. In a process for producing acetic acid, oxygen gas is bubbled into acetaldehyde, CH_3CHO , containing manganese (II) acetate (catalyst) under pressure at $60^\circ C$.



In a laboratory test of this reaction, 20.0 g CH_3CHO and 10.0 g O_2 were put into a reaction vessel. (A) How many grams of acetic acid can be produced by this reaction from these amounts of reactants? (5 points) (B) How many grams of the excess reactant remain after the reaction is complete? (5 points)

5. Suppose you mix 100 mL of 0.02 M $BaCl_2$ with 50 mL of 0.03 M Na_2SO_4 . Will $BaSO_4$ ($K_{sp} = 1.1 \times 10^{-10}$) precipitate? You must calculate to demonstrate your answer. (8 points)
6. When administered intravenously to rats, procaine and cocaine have LD_{50} values of 50 mg/kg and 17.5 mg/kg, respectively. (a) What is the LD_{50} value? (4 points) (b) Which is more toxic? Explain. (4 points)
7. (A) Calculate the molality of C_2H_5OH in a water solution that is prepared by mixing 100 mL of C_2H_5OH with 250 mL of H_2O at $20^\circ C$. The density of the C_2H_5OH is 0.79 g/mL at $20^\circ C$? (5 points)
(B) How many grams of potassium permanganate, $KMnO_4$, are needed to prepare 500 mL of 0.3 M solution? (5 points)
8. The internal energy of a fixed quantity of an ideal gas depends only on its temperature. If a sample of an ideal gas is allowed to expand against a constant pressure at a constant temperature, (a) what is internal energy change (ΔU) for the gas? (5 points) (b) Does the gas do work? (5 points) (c) Is any heat exchanged with the surroundings? (5 points) (Hint: First law of thermodynamic can be used in this problem.)

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科目： 普通化學

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9. An ideal gas undergoes the following sequence of mechanically reversible process in a closed system:

(a) From an initial state of 70°C and 1 bar, it is compressed adiabatically to 150°C

(b) It is then cooled from 150°C to 70°C at constant pressure.

(c) Finally, it's expanded isothermally to its original state.

Calculate work (W) (5 points), internal energy changes (ΔU) (5 points), and enthalpy changes (ΔH) (5 points) for each of the three processes and for the entire cycle.