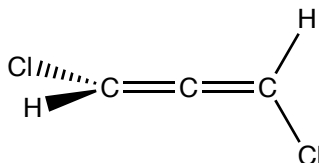


Chemistry 2000 review problems on organic chemistry, acids and bases

1. The following molecule is an allene derivative:



- (a) Is this molecular chiral?
- (b) Predict the products of the addition reaction with
- exactly one equivalent of HBr, or
 - excess HBr.
2. (a) Calculate the pH of a 6.3×10^{-4} mol/L aqueous sodium sulfite (Na_2SO_3) solution at 25°C . The K_b of the sulfite ion is 1.6×10^{-7} .
- (b) I only gave you one K_b , but clearly the sulfite ion can be protonated twice. Why don't we need to consider the second protonation?
3. (a) 15 g of sodium dihydrogen phosphate (NaH_2PO_4 , molar mass 119.98 g/mol) is dissolved in 150 mL of water. What is the pH of the solution? The $\text{p}K_a$ of the first proton of the dihydrogen phosphate anion is 7.2 at 298.15 K.
- (b) The dihydrogen phosphate anion (H_2PO_4^-) can act either as an acid or a base. The question above makes at least two assumptions:
- Dihydrogen phosphate will act as an acid rather than a base.
 - The dissociation of a second proton is not significant.

How could you justify these two assumptions? If you would need additional data to do so, indicate what data you would need.

4. Will an acid-base reaction occur between sulfite (SO_3^{2-}) and the dihydrogen phosphate ion (H_2PO_4^-) in aqueous solution at 25°C ? You will need data from the previous problems to solve this one.
5. Which of the following pair of acids would you expect to be the stronger acid, and why?

