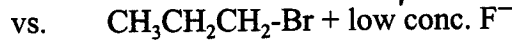
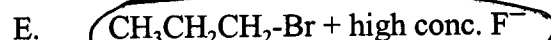
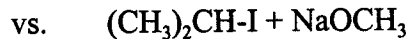
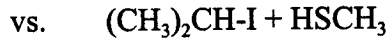
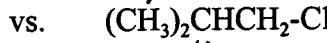
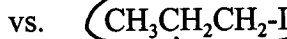


3. Specify how each of the following affects the rate of an  $S_N1$  reaction. Does it increase, decrease, or have no effect on the rate of an  $S_N1$  reaction?  $\text{Rate}_{S_N1} = k[R-X]$  for  $S_N1$  rate does not depend on conc. of nucleophile
- increase in concentration of nucleophile **No effect**
  - decrease in nucleophile strength **No effect but does decrease rate of  $S_N2$  relative to  $S_N1$**
  - decrease in concentration of alkyl halide **Decrease**
  - increase in strength of halide as a leaving group **Increase**
  - increase in polarity of solvent **Increase** \* polar solvent helps to stabilize the intermediate carbocation formed.
  - change in alkyl halide from  $3^\circ$  to  $1^\circ$  **Decrease**

4. Specify how each of the following affects the rate of an  $S_N2$  reaction. Does it increase, decrease, or have no effect on the rate of an  $S_N2$  reaction?  $\text{Rate}_{S_N2} = k[R-X][\text{Nuc.}]$
- increase in concentration of nucleophile **Increase**
  - decrease in nucleophile strength **Decrease**
  - decrease in concentration of alkyl halide **Decrease**
  - increase in strength of halide as a leaving group **Increase**
  - increase in polarity of solvent **Decrease** \* protic solvent tends to make strong, negatively charged nucleophiles less nucleophilic because the polar solvent associates or solvates the nucleophile.
  - change in alkyl halide from  $3^\circ$  to  $1^\circ$  **Increase**

5. Circle which of the following will proceed faster by an  $S_N2$  reaction mechanism.



$\text{SCH}_3$  stronger nucleophile than  $\text{HSCH}_3$

$\text{SCH}_3$  stronger nucleophile than  $\text{OCH}_3$

Since  $\text{Rate}_{S_N2} = k[R-X][\text{Nuc.}]$   
As  $[\text{Nuc.}] \uparrow$   $\text{Rate}_{S_N2} \uparrow$

6. Circle which of the following will proceed faster by an S<sub>N</sub>1 reaction mechanism.



- A.  $(CH_3)_3C-Br$  vs.  $(CH_3)_3CCH_2-Br$   $3^\circ > 2^\circ > 1^\circ > \text{methyl}$
- B. chlorocyclopentane + low conc. OH<sup>-</sup> vs. chlorocyclopentane + high conc. of OH<sup>-</sup>
- C. iodocyclohexane + NH<sub>2</sub><sup>-</sup> vs. iodocyclohexane + NH<sub>3</sub>
- D.  $(CH_3)_2CH-I$  + HSCH<sub>3</sub> (polar protic solvent) vs.  $(CH_3)_2CH-I$  + HSCH<sub>3</sub> (CCl<sub>4</sub> solvent; a non-polar aprotic solvent)

The  $SN_2$  is a strong base strong nucleophile will undergo  $SN_2$  or  $E_2$ . But if want more of  $SN_2$  product use the weaker nucleophile.

both have ~ same  $SN_1$  rate because  $R_{SN_2} \neq R_{E_2}$  + does not depend on [Nuc]. However, w/ high conc. OH<sup>-</sup>  $SN_2$  is more favored.

- Specify how each of the following affects the rate of an E1 reaction. Does it increase, decrease, or have no effect on the rate of an E1 reaction?
- A. increase in concentration of base **No effect** //  $\text{Rate } E_1 = k [R-X]$
- B. increase in base strength **No effect but tends to increase E2 rate relative to E1 rate.**
- C. increase in concentration of alkyl halide **Increase**
- D. decrease in strength of halide as a leaving group **Decrease** ← since first step involves halide leaving, the less halide wants to leave, the slower the E1 mechanism
- E. change in alkyl halide from 1° to 3° **Increase**  $\text{Rate } E_1: 3^\circ > 2^\circ > 1^\circ$

8. Specify how each of the following affects the rate of an E2 reaction. Does it increase, decrease, or have no effect on the rate of an E2 reaction?
- A. decrease in concentration of base **Decrease**
- B. decrease in base strength **Decrease**
- C. decrease in concentration of alkyl halide **Decrease**
- D. increase in strength of halide as a leaving group **Increase**
- E. change in alkyl halide from 3° to 1° **Decrease**  $\text{Rate } E_2: 3^\circ > 2^\circ > 1^\circ$

9. Circle which of the following pairs will give a higher yield of elimination product over substitution product.
- A.  $2^\circ (CH_3)_2CH-I$  + NaOH vs.  $1^\circ CH_3CH_2CH_2-I$  + NaOH
- B.  $2^\circ (CH_3)_2CH-I$  + KOOC(CH<sub>3</sub>)<sub>3</sub> vs.  $2^\circ (CH_3)_2CH-I$  + KOCH<sub>3</sub>
- C.  $3^\circ (CH_3)_3C-Br$  + NaSCH<sub>3</sub> vs.  $2^\circ (CH_3)_2CH-Br$  + NaSCH<sub>3</sub>
- D.  $(CH_3)_2CH-I$  + NaCN low temperature vs.  $(CH_3)_2CH-I$  + NaCN high temperature.