**Organic Chem 3514 Alfred State**

 **SN2 Mechanism Exercises**

1. Identify the α, β and γ sites (if any) on the molecules below.





A B C D

2. Identify the 0o , 1o (primary), 2o(secondary) and 3o (tertiary carbons) (if any) on the

 molecules above.

3. Alkyl halides undergo two basic kinds of reactions: \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. Define what the acronym SN2 stands for

5. The SN2 mechanism involves (circle all that apply):

 3 coordinated carbocation 5 coordinated complex stepwise mechanism

 concerted mechanism leaving group proton transfer

electron transfer racemization inversion

6. What motivates the halide to R-X align itself on a line opposite the attacking nucleophile?

7. There are 5 factors governing the rate of an SN2 reaction. Name them.

 1)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 3)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 5)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Order the 4 alkyl halides in problem 1 in order from fastest to slowest SN2 rate

 \_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_\_\_

9. Using the pKa below, order the leaving groups from best to worst.

**Compound** **H-OC2H5  H-NH2  H-Cl H-F H-I H-Br**

**pKa****16 36 -7 3 -11 -9**

 \_\_\_\_\_\_\_\_> \_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_\_>\_\_\_\_\_\_\_\_

10. Order the alkyl halides below from fastest to slowest SN2 reaction rates.

\_\_\_\_>\_\_\_\_>\_\_\_\_>\_\_\_\_>\_\_\_\_>\_\_\_\_



A B C

D E F

11. Circle the true statements about SN2 below.

a) SN2 reactions run best in polar, aprotic solvents because the solvent does not solvate the

 nucleophile.

b) A good nucleophile for SN2 is a strong base.

c) A good nucleophile for SN2 is very polarizable.

d) Steric effects are unimportant in SN2.

e) A good leaving group is one where the conjugate acid pKa of the group is negative (-).

f) SN2 rates follow the order 0o < 1o < 2o <3o with respect to the α carbon in RX.

g) β carbon crowding is not as important as α-carbon crowding in lowering SN2 rates

h) The ranking of I, Br, Cl and F as nucleophiles in an SN2 follows the order: I>Br>Cl>F in

 polar, aprotic solvents

12. From the list below, pick the substrate, nucleophile and solvent that would run fastest via SN2

 **Substrate nucleophile solvent**

 2-chlorobutane F‑ H2O

 1-chloro-2-methylpentane CH3CH2OH CH3OH

 2-chloro-3-methylpropane I- CH3CN

 1-chloropentane NH3 NH3

13. Which is the better nucleophile ?

 CH3OH or CH3O-

CH3O- or C2H5S-

 COOH- or C2H5O-

 CH3-O- or CH2Cl-O-

14. Any day doing Organic chemistry is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_day.