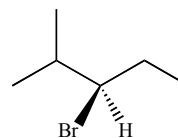


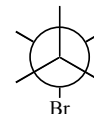
1. (2) In the blank write the correct IUPAC name of molecule A.



Molecule A

\_\_\_\_\_

2. (2) Complete this drawing of the *most* stable conformation of molecule A, as viewed along the bond between the CH<sub>2</sub> group and the carbon bearing the bromine atom.

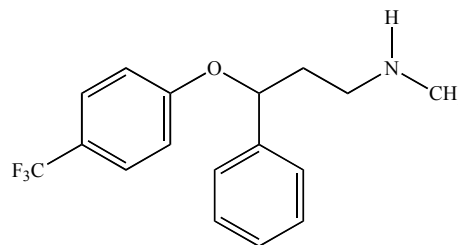


3. (3) Complete this statement by adding *no more than ten words*: Of the infinite number of conformations for this bond of molecule A, this one has the least strain and the lowest energy because it has...

4. (2) Draw in the box an isomer of molecule A that is a tertiary alkyl bromide.

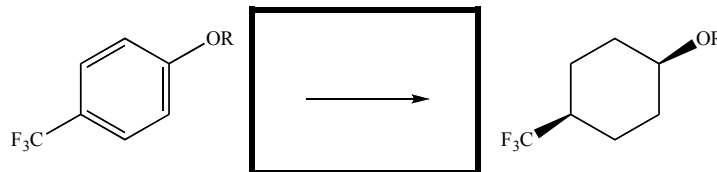


Fluoxetine (Prozac) an antidepressant and selective serotonin reuptake inhibitor and therefore an antidepressant. Among the most popular drugs in the US, over 22 million fluoxetine prescriptions were written in 2007.



Fluoxetine

5. (2) Circle the name of the functional group(s) *not* present in fluoxetine.  
 Alkyl halide    Alkene    Amide    Amine    Benzene ring    Ether
6. (2) The nitrogen atom of fluoxetine is (circle one):  $sp^3$      $sp^2$      $sp$     not hybridized
7. (2) Write the electronegativity values (to one decimal place) in the blank next to each of these atoms found in fluoxetine:  
 F \_\_\_\_\_ C \_\_\_\_\_ H \_\_\_\_\_ N \_\_\_\_\_ O \_\_\_\_\_
8. (2) Complete the following hypothetical reaction that might be used to convert fluoxetine into molecule B. ('OR' is an abbreviation for a portion of the molecular structure.) *Hint: Although you have not seen this exact reaction before, you've seen something very much like it.*



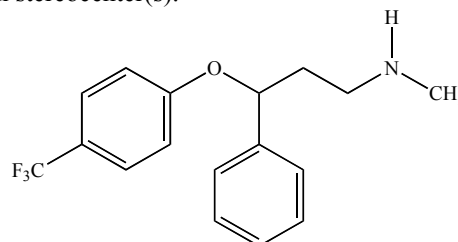
Molecule B



9. (3) Draw in the box the most stable conformation of molecule **B**.

10. (2) Write a number in the blank. Fluoxetine has \_\_\_\_\_ carbon stereocenter(s).

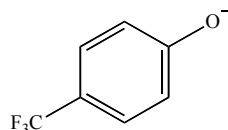
11. (2) Complete this drawing of fluoxetine so that all carbon stereocenters have an *R* configuration.



12. (4) Write numbers in the blanks. Prozac contains an equal amount of all fluoxetine stereoisomers. Therefore Prozac contains \_\_\_\_\_ fluoxetine stereoisomers that are enantiomers of other fluoxetine stereoisomers, and \_\_\_\_\_ fluoxetine stereoisomers that are diastereomers of other fluoxetine stereoisomers.

13. (2) Complete this sentence by writing **up to five words** in the blank. Based on the question 12, the word or phrase which best describes the stereoisomer mix in Prozac is \_\_\_\_\_.

14. (3) In the Contributor 2 box, draw an additional, significant resonance structure for Contributor 1. **A less significant contributor will earn less credit.**

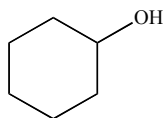
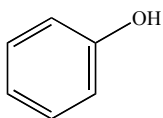
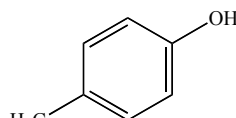
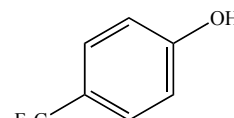


Contributor # 1

Contributor # 2

15. (1) Which resonance contributor is more significant? Circle one: # 1      #2      Equal significance

Questions 16 and 17 refer to molecules **C–F**:

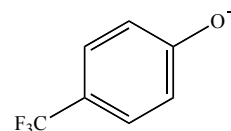
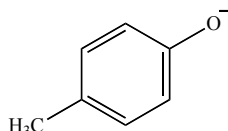
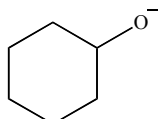
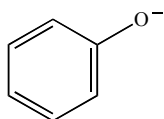
**C****D****E****F**

16. (4) Write letters in the blanks. \_\_\_\_\_ has the *least acidic* OH group and \_\_\_\_\_ has the *most acidic* OH.
17. (4) Using **no more than ten words** in each case, give two significant, distinctly different reasons why the molecule you chose in the question 16 with the most acidic OH group is more acidic than other molecules in this set.

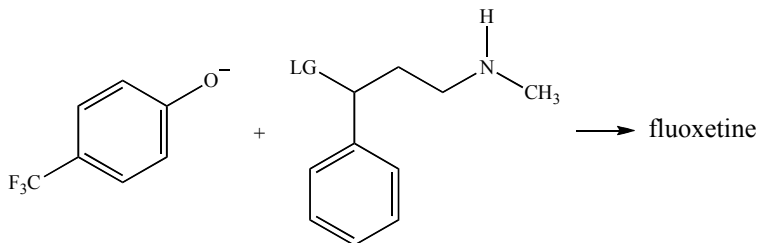
Reason #1:

Reason #2:

18. (2) Circle the *weakest* nucleophile in a polar, aprotic solvent:



Questions 19–21 refer this intermolecular  $S_N2$  reaction, part of a hypothetical fluoxetine synthesis. (LG = unspecified leaving group.)



19. (2) Circle the solvent that will give the *fastest* rate for this  $S_N2$  reaction:

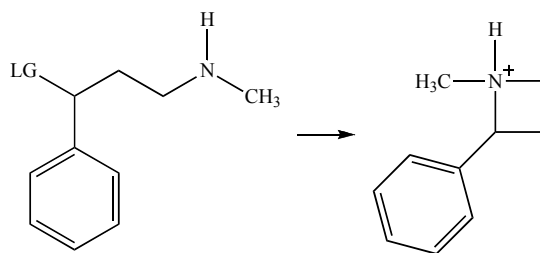
Water    DMF     $\text{CH}_3\text{OH}$      $\text{CH}_3\text{CH}_2\text{OH}$     Acetone    Hexane

20. (5) Circle the *best* leaving group (LG) for this  $S_N2$  reaction: LG = F    LG = Cl    LG = Br    LG = I    LG = OH

Complete this explanation by adding **no more than ten words**: This is the best leaving group because...

21. (2) If we want the  $S_N2$  reaction product to have the *R* configuration, the configuration of the reaction's electrophile must be (circle one): *R*    *S*    Neither    Cannot determine

22. (4) In addition to the intermolecular  $S_N2$  reaction leading to fluoxetine, this intramolecular  $S_N2$  reaction might also occur:

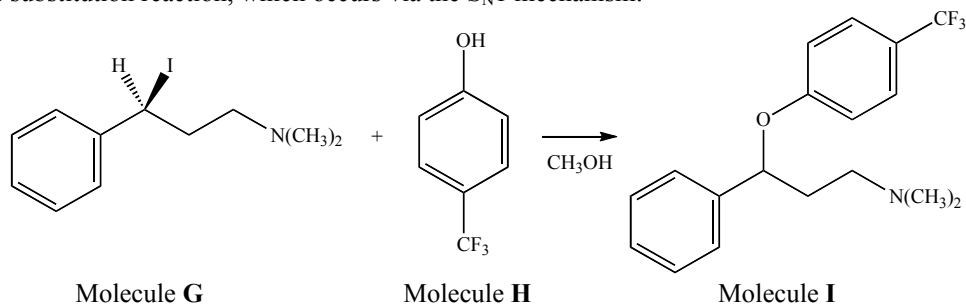


Using **no more than fifteen words** in each case, list two reasons why the intermolecular  $S_N2$  (reaction near top of page) is more favorable than the intramolecular  $S_N2$  (shown here).

Reason #1:

Reason #2:

Consider this substitution reaction, which occurs via the  $S_N1$  mechanism:



23. (6) Write an  $S_N1$  mechanism for the formation of molecule **I**. *OK to use 'Ph' where appropriate.*

24. (3) Draw the structure of another reasonable  $S_N1$  product formed in the reaction of molecules **G** and **H** in  $\text{CH}_3\text{OH}$ .

25. (2) The stereochemical configuration of molecule **I** is (circle one):

All *S*      Mostly *S*, some *R*      1:1 mixture of *S* and *R*      Mostly *R*, some *S*      All *R*

26. (6) By adding, subtracting, or otherwise changing into another element **at most three atoms** anywhere in the reaction, rewrite the  $S_N1$  reaction of molecules **G** and **H** so it is obviously *faster*. The mechanism must remain  $S_N1$ ; it cannot switch to  $S_N2$ . Include the reaction product but do not write out the mechanism.

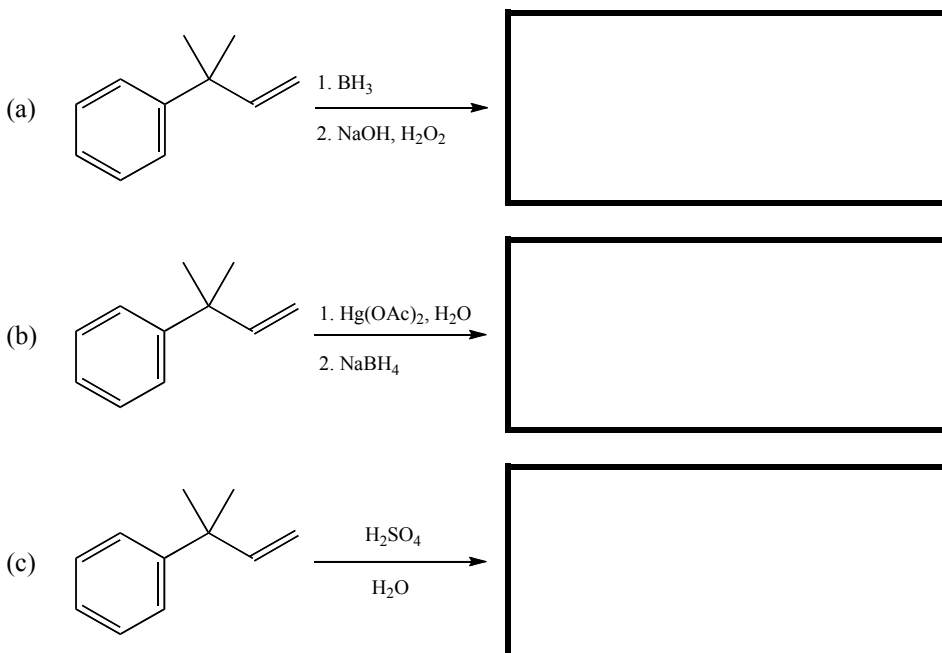
Complete this explanation by adding **no more than fifteen words**: My revised reaction is faster than the given reaction because....

27. (4) Can molecules **G** and **H** also react by an E2 mechanism, to give an alkene product? If yes, circle 'yes' and then draw the E2 mechanism and product. If no, circle 'no', and by *using no more than fifteen words*, explain why E2 cannot occur.

Circle one: Yes   No

28. (5) Assume that molecules **G** and **H** react in CH<sub>3</sub>OH by the E1 mechanism. Write the major E1 reaction product and the mechanism for its formation.

29. (9) The reactions show below give three *different isomers* of C<sub>11</sub>H<sub>16</sub>O. Draw the product of each reaction in the corresponding boxes.



30. (8) Write the mechanism for the formation of the product you drew in question 29(c).