

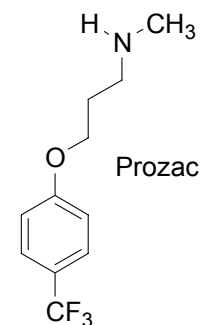
# State University of New York at Stony Brook

## Department of Chemistry CHE 321 Fall 2002 Exam 1 Form 1

**Multiple Choice.** Only one selection (A, B, C, D, or E) should be made for each question.

1. Choose the correct molecular formula for the antidepressant drug Prozac.

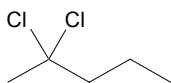
- (A)  $C_{11}H_{14}NO$     (B)  $C_{11}H_{13}NO_2$     (C)  $C_{11}H_{14}NOF_3$     (D)  $C_{15}H_{21}NF_3$     (E)  $C_{15}H_{21}NOF_3$



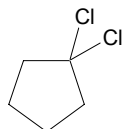
2. Choose a functional group present in Prozac.

- (A) ketone    (B) amine    (C) alcohol    (D) aldehyde    (E) amide

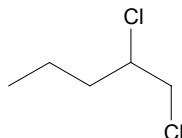
3. Choose the answer whose structure(s) are constitutional isomers of the structure shown on the right.



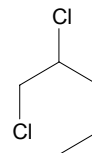
(1)



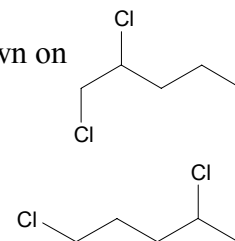
(2)



(3)



(4)



(5)

(A) 1

(B) 2 + 3

(C) 5

(D) 1 + 5

(E) 2 + 3

4. Choose the answer that has the following compounds arranged correctly with respect to *boiling points*. (lowest boiling point on the left).

	less than (1)			less than (2)	
	less than (3)			less than (4)	

(A) only 1

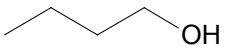
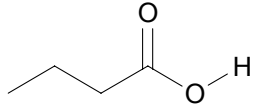
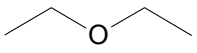
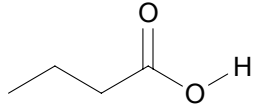
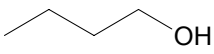
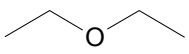
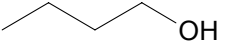
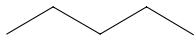
(B) only 4

(C) only 2 + 3

(D) only 1 + 3

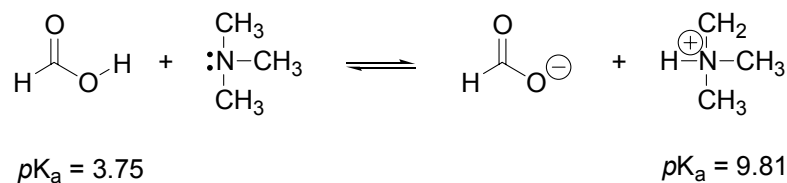
(E) only 1 + 2

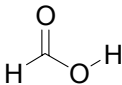
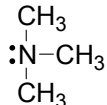
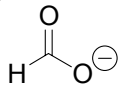
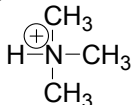
5. Choose the answer that has the following compounds correctly arranged with *solubility* in water (lowest solubility in water on the left).

	less than (1)			less than (2)	
	less than (3)			less than (4)	

- (A) only 1      (B) only 4      (C) only 2 + 3      (D) only 1 + 3      (E) only 1 + 2

6. Choose the weakest base in the following equilibrium.



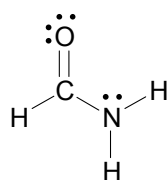
- (A)       (B)       (C)       (D)       (E) none of the above

7. Choose the answer with all true statements about the C-C bond in ethane.

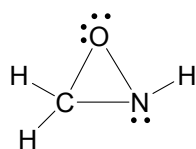
- (1) It called a  $\pi$ -bond.  
 (2) It is called a  $\sigma$ -bond.  
 (3) The bond is formed using two  $Csp^2$  hybrid orbitals.  
 (4) There are two molecular orbitals, bonding and antibonding, involved in this bond.

- (A) 1      (B) 2      (C) 2 + 3 + 4      (D) 2 + 4      (E) 2 + 3

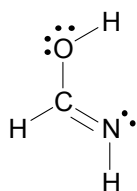
8. Select from the answers those that are resonance structures of the molecule (A) shown below on the left.



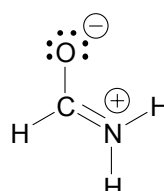
A



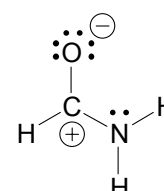
(1)



(2)



(3)



(4)

(A) only 1 + 2

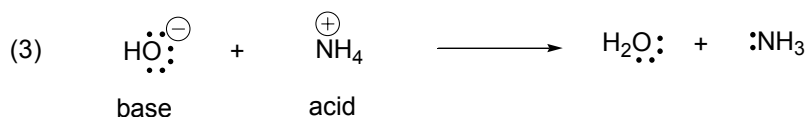
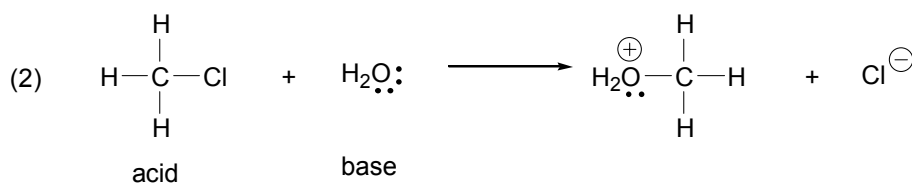
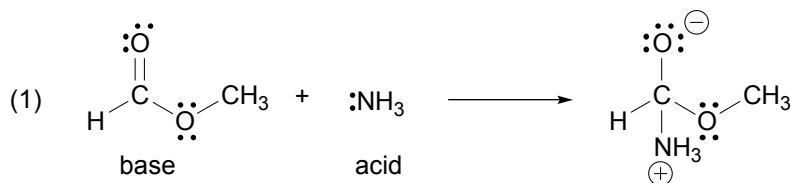
(B) only 1 + 3

(C) only 3

(D) only 3 + 4

(E) only 1 + 2 + 4

9. Choose the answer that has the acids and bases correctly identified in the following reactions.



(A) only 1 + 2

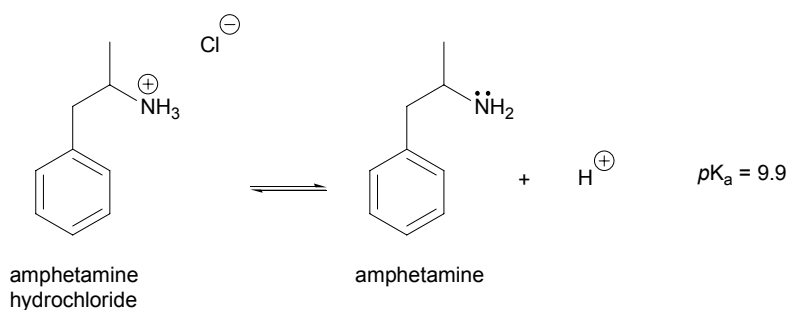
(B) only 2

(C) 1 + 3

(D) only 2 + 3

(E) only 4

10. The  $pK_a$  of hydrochloride salt of amphetamine is equal to 9.9.



(1) The major species present in blood, buffered at  $pH = 7.4$ , is amphetamine.

(2) The major species present in blood, buffered at  $pH = 7.4$ , is amphetamine hydrochloride.

(3) amphetamine hydrochloride is behaving as an acid in the above equation.

(A) only 1 + 2

(B) only 1 + 3

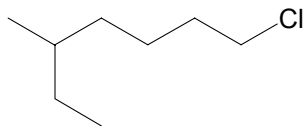
(C) 2 + 3

(D) only 2

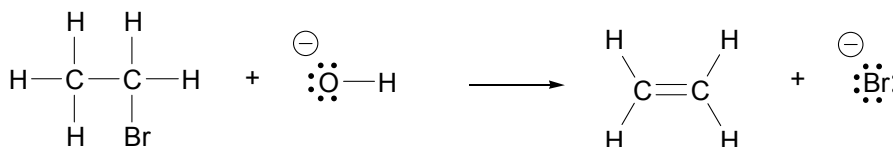
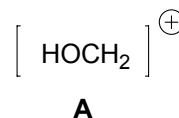
(E) only 3

**Essay Questions:** Be thoughtful and efficient because on the exam answer sheet there is only limited space available for your answer. You must place your answer in the designated space.

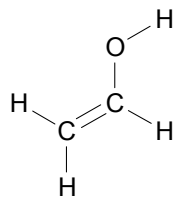
1. Give the structure of *trans*-1,2-dichlorocyclobutane. (5 pts)
2. Give an acceptable name for the following structure. (5 pts)



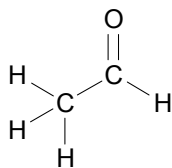
3. Draw the four isomeric amides with the formula  $C_3H_7NO$  and circle the structure with the lowest boiling point. Give a reason for your choice. (10 pts).
4. Consider the ion **A** with the bond connectivity shown on the right.
  - (a) Give the two best resonance structures for this ion. (6 pts)
  - (b) Use VSEPR theory and draw the three dimensional structure of this ion. (4 pts)
5. Two isomeric compounds, **A** and **B**, have the formula  $C_3H_6O$ . The infrared spectra (dilute solutions,  $CCl_4$ ) of both **A** and **B** *do not* show absorptions in the  $3590-3650\text{ cm}^{-1}$  region. Compound **A** shows an absorption at  $1739\text{ cm}^{-1}$ . There are no absorptions in the  $1680-1750\text{ cm}^{-1}$  region for compound **B**. Postulate structures for **A** and **B** and identify the functional groups present in your postulated structures. (10 pts)
6. Using the curved arrow formalism show the bond making and bond breaking in the following acid base reaction. (10 pts)



*Bonus question:* Vinyl alcohol and acetaldehyde both behave as weak acids. The ionization of vinyl alcohol and acetaldehyde both give the *same* conjugate base. Vinyl alcohol and acetaldehyde are constitutional isomers but vinyl alcohol is less stable than acetaldehyde. (10 pts)



vinyl alcohol



acetaldehyde

- (a) Give an explanation for why these two acids give the *same* conjugate base.
- (b) Acetaldehyde has a  $pK_a = 20$ . Predict whether vinyl alcohol is stronger or weaker acid than acetaldehyde and give a reason for your prediction.