Student name:\_\_\_\_\_\_\_\_\_\_

**1)** What is the electrophilic site in the following compounds?  
  
ch02_fig47_smith_jpg.ext

A) I = Chlorine; II = carbon; III = boron.   
 B) I = Carbon; II = oxygen; III = boron.  
 C) I = Carbon; II = carbon; III = boron.  
 D) I = Carbon; II = carbon; III = fluorine.

**2)** What is the direction of equilibrium when acetylene (C2H2) reacts with ethoxide (CH3CH2O−) in an acid-base reaction?  
  
ch02_fig30_smith.jpg

A) Cannot be determined   
 B) Neither  
 C) Left  
 D) Right

**3)** Which of the following is a Lewis acid but not a Brønsted-Lowry acid?

A) CH3COOH   
 B) H2O  
 C) BF3  
 D) CH3OH

**4)** Which is the conjugate base in the following reaction?  
  
ch02_fig11_smith.jpg

A) I   
 B) III  
 C) II  
 D) IV

**5)** Identify the Lewis base in the following reaction.  
  
ch02_fig44_smith_jpg.ext

A) IV   
 B) II  
 C) III  
 D) I

**6)** What are the products of the following proton transfer reaction?  
  
ch02_fig50_smith_jpg.ext

A) IV   
 B) II  
 C) I  
 D) III

**7)** Which of the following is an acid commonly used it organic reactions?

A) HNO3   
 B) KOH  
 C) H2SO4  
 D) HCl

**8)** What is the role of methylchloride (CH3Cl) in the following reaction?  
  
ch02_fig46_smith.jpg

A) Brønsted-Lowry base   
 B) Brønsted-Lowry acid  
 C) Lewis base  
 D) Lewis acid

**9)** Which of the following would have the lowest pKa?

A) CH3CH2CH2CHClCOOH   
 B) CH3CHClCH2CH2COOH  
 C) ClCH2CH2CH2CH2COOH  
 D) CH3CH2CHClCH2COOH

**10)** Which of the following will proceed as written?

A) CH3OH + H2O → CH3O− + H3O+   
 B) CH3OH + NH3 → CH3O− + NH4±  
 C) CH3OH + NaCl → NaOEt + HCl  
 D) CH3ONa + HCl → CH3OH + NaCl

**11)** Which of the following compounds has the lowest pKa?

A) H2S   
 B) H2O  
 C) CH4  
 D) NH3

**12)** Identify the base/conjugate base (in that order) in the following reaction:  
  
ch02_fig56_smith.jpg

A) II, IV   
 B) I, IV  
 C) I, III  
 D) II, III

**13)** Which of the following statements about a Brønsted-Lowry base is true?

A) All Brønsted-Lowry bases contain a proton.   
 B) All Brønsted-Lowry bases contain a lone pair of electrons or a π bond.  
 C) The net charge may be zero, positive, or negative.  
 D) The net charge may be zero or positive.

**14)** Identify the Lewis acid in the following reaction.  
  
ch02_fig43_smith_jpg.ext

A) II   
 B) III  
 C) I  
 D) IV

**15)** Which of the following compounds is the strongest acid?  
  
ch02_fig15_smith.jpg

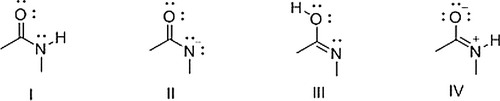
A) IV   
 B) I  
 C) II  
 D) III

**16)** What is the nucleophilic site in the following compounds?  
  
ch02_fig48_smith.jpg

A) I = Oxygen; II = π electrons in bond; III = nitrogen.   
 B) I = Oxygen; II = carbon; III = nitrogen.  
 C) I = Hydrogen; II = carbon; III = carbon.  
 D) I = Hydrogen; II = π electrons in bond; III = nitrogen.

**17)** Which of the following statements explains why H2O is a stronger acid than CH4?

A) CH4 forms a more stable conjugate base, CH3−.   
 B) H2O forms a more stable conjugate base, HO−.  
 C) H2O forms a less stable conjugate base, HO−.  
 D) H2O can form hydrogen bonds while CH4 cannot.

**18)** Consider the following structures I-IV. Which two species represent resonance structures?  
  


A) II and IV   
 B) I and III  
 C) I and II  
 D) I and IV

**19)** Which of the following is the strongest base?

A) H2O   
 B) CH3COCH3  
 C) NH3  
 D) CH3COOH

**20)** Which of the following statements about Lewis acids is true?

A) Lewis acids are electron pair donors.   
 B) Lewis acids are proton acceptors.  
 C) Lewis acids are electron pair acceptors.  
 D) Lewis acids are proton donors.

**21)** Which of the following statements about Brønsted-Lowry acids and bases is true?

A) Gain of a proton by an acid forms its conjugate base.   
 B) Loss of a proton from an acid forms its conjugate base.  
 C) Brønsted-Lowry acid-base reactions always result in the transfer of a proton from a base to an acid.  
 D) Loss of a proton from a base forms its conjugate acid.

**22)** Rank the following compounds in order of increasing acidity, putting the least acidic first.  
  
ch02_fig22_smith.jpg

A) III < I < II < IV   
 B) III < I < IV < II  
 C) II < I < IV < III  
 D) III < IV < I < II

**23)** Which of the following species is the conjugate acid of ammonia, NH3?

A) H4N   
 B) H3N+  
 C) H4N+  
 D) H2N−

**24)** Which of the following statements about Lewis bases is true?

A) Lewis bases are proton donors.   
 B) Lewis bases are electron pair donors.  
 C) Lewis bases are electron pair acceptors.  
 D) Lewis bases are proton acceptors.

**25)** What is the correct rank of the following compounds in order of increasing acidity?  
  
ch02_fig51_smith.jpg

A) IV > I > II > III   
 B) III > I > IV > II  
 C) IV > III > II > I  
 D) I > II > III > IV

**26)** Which of the following concepts can be used to explain the difference in acidity between acetic acid (CH3COOH) and ethanol (CH3CH2OH)?

A) Electronegativity   
 B) Resonance  
 C) Hybridization  
 D) Size

**27)** Rank the following compounds in order of decreasing acidity, putting the most acidic first.  
  
ch02_fig37_smith.jpg

A) I > II > III   
 B) III > II > I  
 C) III > I > II  
 D) II > III > I

**28)** Which of the following species can be both Lewis acid and Lewis base?  
  
ch02_fig41_smith.jpg

A) I, II, IV   
 B) I, II, III  
 C) I, III, IV  
 D) II, III, IV

**29)** What is the direction of equilibrium when acetylene (C2H2) reacts with H2N− in an acid-base reaction?  
  
ch02_fig29_smith.jpg

A) Right   
 B) Cannot be determined  
 C) Left  
 D) Neither

**30)** Which of the following ranks the compounds in order of increasing acidity, putting the least acidic first?

A) CH4 < NH3 < H2O   
 B) CH4 < H2O < NH3  
 C) NH3 < CH4 < H2O  
 D) H2O < NH3 < CH4

**31)** Which is the conjugate acid in the following reaction?  
  
ch02_fig12_smith.jpg

A) II   
 B) I  
 C) III  
 D) IV

**32)** Which of the following compounds is*not* a Lewis acid?

A) HCl   
 B) CBr4  
 C) AlCl3  
 D) H2O

**33)** What is the correct classification of the following compound?  
CH3-O-CH3

A) Lewis base   
 B) Brønsted-Lowry base and Lewis base  
 C) Brønsted-Lowry base  
 D) Brønsted-Lowry acid and Lewis acid

**34)** Which of the following compounds is the strongest acid?

A) CH3OH   
 B) BrCH2OH  
 C) CH3NH2  
 D) CH3Cl

**35)** What is the conjugate base of HSO4−?  
SO42− H2SO4 SO3 H2O  
  
 I II III IV

A) IV   
 B) I  
 C) III  
 D) II

**36)** Which is the conjugate base in the following reaction?  
  
ch02_fig13_smith.jpg

A) IV   
 B) II  
 C) I  
 D) III

**37)** Which of the following species is not a Brønsted-Lowry base?

A) H2O   
 B) NH3  
 C) PO43−  
 D) BF3

**38)** Which of the following species cannot act as both a Brønsted-Lowry acid and base?

A) HO−   
 B) H2PO4−  
 C) HSO4−  
 D) HCO3−

**39)** Which of the following statements explain why HBr is a stronger acid than HF?

A) Br− is less stable than F− because Br− is less electronegative than F−.   
 B) Br− is less stable than F− because Br− is larger than F−.  
 C) Br− is more stable than F− because Br− is less electronegative than F−.  
 D) Br− is more stable than F− because Br− is larger than F−.

**40)** Which of the following statements is a correct definition for a Brønsted-Lowry acid?

A) Proton acceptor   
 B) Proton donor  
 C) Electron pair donor  
 D) Electron pair acceptor

**41)** Which of the following statements about acid strength is true?

A) The stronger the acid, the smaller the pKa.   
 B) The stronger the acid, the further the equilibrium lies to the left.  
 C) The stronger the acid, the smaller the Ka.  
 D) The stronger the acid, the larger the pKa.

**42)** Which of the following species is the conjugate base of methanol, CH3OH?

A) CH3O−   
 B) CH3OH2+  
 C) CH4  
 D) CH3−

**43)** Rank the following compounds in order of decreasing acidity, putting the most acidic first.  
  
ch02_fig25_smith.jpg

A) IV > II > III > I   
 B) III > IV > I > II  
 C) III > IV > II > I  
 D) IV > III > II > I

**44)** Which of the following species is the weakest base?

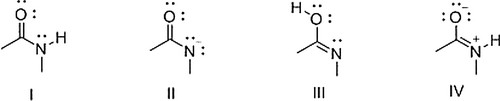
A) HO−   
 B) H2N−  
 C) CH3COO−  
 D) Cl−

**45)** Rank the following compounds in order of increasing acidity, putting the least acidic first.  
  
ch02_fig23_smith.jpg

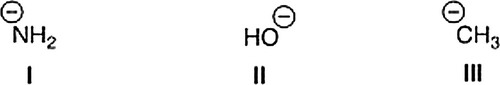
A) I < IV < III < II   
 B) II < III < IV < I  
 C) I < III < IV < II  
 D) II < IV < III < I

**46)** Which of the following is an acid commonly used it organic reactions?

A) NaOH   
 B) NaNH2  
 C) HCl  
 D) KOH

**47)** Consider the following structures I-IV. Which two species represent constitutional isomers?  
  


A) I and III   
 B) I and II  
 C) I and IV  
 D) II and IV

**48)** Rank the following conjugate bases in order of increasing basicity, putting the least basic first.  
  


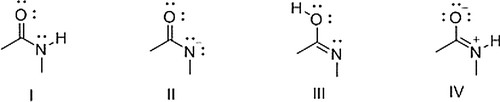
A) II < I < III   
 B) I < III < II  
 C) I < II < III  
 D) II < III < I

**49)** Identify the acid/conjugate acid (in that order) in the following reaction:  
  
ch02_fig55_smith.jpg

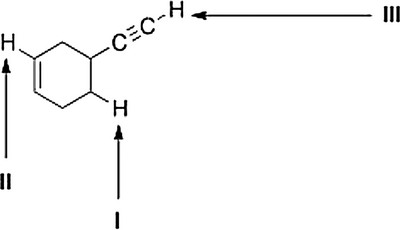
A) II, IV   
 B) II, III  
 C) I, IV  
 D) I, III

**50)** Which of the following ranks the compounds in order of increasing basicity, putting the least basic first?

A) CH3NH2 < CH3OH < CH4   
 B) CH4 < CH3NH2 < CH3OH  
 C) CH4 < CH3OH < CH3NH2  
 D) CH3OH < CH3NH2 < CH4

**51)** Consider the following structures I-IV. Which two species represent a conjugate acid-base pair?  
  


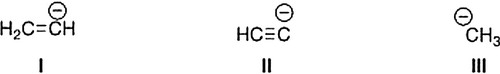
A) II and III   
 B) I and IV  
 C) I and II  
 D) I and III

**52)** Consider the following molecule with protons labeled, I-III. Rank these protons in order of decreasing acidity, putting the most acidic first.  
  


A) III > I > II   
 B) III > II > I  
 C) I > III > II  
 D) I > II > III

**53)** Which of the following compounds is the weakest acid?

A) HCl   
 B) HF  
 C) HBr  
 D) HI

**54)** Rank the following conjugate bases in order of decreasing basicity, putting the most basic first.  
  


A) I > II > III   
 B) III > I > II  
 C) III > II > I  
 D) II > I > III

**55)** Which of the following concepts can be used to explain the difference in acidity between acetylene (C2H2) and ethylene (C2H4)?

A) Inductive effect   
 B) Size  
 C) Hybridization  
 D) Resonance

**56)** Rank the following compounds in order of decreasing acidity, putting the most acidic first.  
  
ch02_fig24_smith.jpg

A) IV > II > III > I   
 B) III > II > IV > I  
 C) III > IV > II > I  
 D) I > II > IV > III

**57)** Which is the conjugate acid in the following reaction?  
  
ch02_fig10_smith.jpg

A) IV   
 B) II  
 C) I  
 D) III

**58)** Which of the following compounds is the weakest acid?

A) PH3   
 B) HCl  
 C) SiH4  
 D) H2S

**59)** Which of the following compounds is both a Brønsted-Lowry acid and base?  
  
ch02_fig03_smith.jpg

A) I, IV   
 B) I, III  
 C) I, II  
 D) II, IV

**60)** Which of the following concepts can be used to explain the difference in acidity between ethanol (CH3CH2OH) and 2-fluoroethanol (FCH2CH2OH)?

A) Inductive effect   
 B) Size  
 C) Resonance  
 D) Hybridization

**61)** Which of the following species is the conjugate base of the hydronium ion, H3O+?

A) H2O   
 B) HO−  
 C) H2O−  
 D) H3O

**62)** Which of the following species is the strongest base?

A) H2N−   
 B) CH3COO−  
 C) HO−  
 D) Cl−

**Answer Key**Test name: Organic Chemistry with Biological Topics , Smith 6th ch2

1) C

2) C

3) C

4) D

5) D

6) B

7) B

8) C

9) A

10) D

11) A

12) B

13) B

14) A

15) A

16) A

17) B

18) D

19) C

20) C

21) B

22) D

23) C

24) B

25) A

26) B

27) C

28) C

29) A

30) A

31) D

32) B

33) B

34) B

35) B

36) D

37) D

38) A

39) D

40) B

41) A

42) A

43) D

44) D

45) A

46) C

47) A

48) A

49) B

50) C

51) C

52) B

53) B

54) B

55) C

56) C

57) D

58) C

59) B

60) A

61) A

62) A