Chapter 2 – Acids and Bases (test bank) KEY

1. Which of the following statements is a correct definition for a Brønsted-Lowry acid?

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

Accessibility: Keyboard Navigation
Bloom's Level: 1. Remember
Difficulty: Easy Gradable: automatic Section: 02.01

Subtopic: Acid/Base definitions
Topic: Acids and Bases

2. Which of the following statements about a Brønsted-Lowry base is true?

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

Accessibility: Keyboard Navigation
Bloom's Level: 1. Remember
Difficulty: Easy Gradable: automatic Section: 02.01

Subtopic: Acid/Base definitions
Topic: Acids and Bases

3. Which of the following compounds is both a Brønsted-Lowry acid and base?

CH_3OH	CH_3COCH_3	H_2O	$(CH_3)_3N$
I	**II**	**III**	**IV**

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.01
Subtopic: Acid/Base definitions
Topic: Acids and Bases

4. Which of the following species cannot act as both a Brønsted-Lowry acid and base?

A. HCO_3^-
B. HSO_4^-
C. HO^-
D. $H_2PO_4^-$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.01

Subtopic: Acid/Base definitions
Topic: Acids and Bases

5. Which of the following species is not a Brønsted-Lowry base?

A. BF_3
B. NH_3
C. H_2O
D. PO_4^{3-}

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.01

Subtopic: Acid/Base definitions
Topic: Acids and Bases

6. Which of the following statements about Brønsted-Lowry acids and bases is true?

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

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.01

Subtopic: Acid/Base definitions
Topic: Acids and Bases

7. Which of the following species is the conjugate base of methanol, CH_3OH?

A. $CH_3OH_2^+$
B. CH_3O^-
C. CH_3^-
D. CH_4

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.01
Subtopic: Acid/Base definitions
Topic: Acids and Bases

8. Which of the following species is the conjugate base of the hydronium ion, H_3O^+?

A. H_3O
B. H_2O^-
C. H_2O
D. HO^-

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.01
Subtopic: Acid/Base definitions
Topic: Acids and Bases

9. Which of the following species is the conjugate acid of ammonia, NH_3?

A. H_4N
B. H_3N^+
C. H_2N^-
D. H_4N^+

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.01
Subtopic: Acid/Base definitions
Topic: Acids and Bases

10. Which is the conjugate acid in the following reaction?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

11. Which is the conjugate base in the following reaction?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

12. Which is the conjugate acid in the following reaction?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

13. Which is the conjugate base in the following reaction?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

14. Which of the following statements about acid strength is true?

A. The stronger the acid, the further the equilibrium lies to the left.
B. The stronger the acid, the smaller the K_a.
C. The stronger the acid, the larger the pK_a.
D. The stronger the acid, the smaller the pK_a.

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

15. Which of the following compounds is the strongest acid?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

16. Which of the following compounds is the strongest acid?

A. CH_3OH
B. $BrCH_2OH$
C. CH_3NH_2
D. CH_3Cl

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

17. Which of the following compounds is the weakest acid?

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

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

18. Which of the following compounds is the weakest acid?

A. H_2S
B. PH_3
C. HCl
D. SiH_4

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

19. Which of the following species is the strongest base?

A. HO^-
B. H_2N^-
C. CH_3COO^-
D. Cl^-

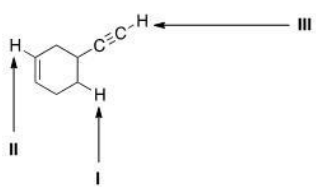
Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

20. Which of the following ranks the compounds in order of increasing basicity, putting the least basic first?

A. $CH_3NH_2 < CH_3OH < CH_4$
B. $CH_3OH < CH_3NH_2 < CH_4$
C. $CH_4 < CH_3NH_2 < CH_3OH$
D. $CH_4 < CH_3OH < CH_3NH_2$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

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



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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

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

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

23. Rank the following compounds in order of increasing acidity, putting the least acidic first.

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

24. Rank the following compounds in order of decreasing acidity, putting the most acidic first.

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

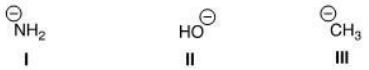
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

25. Rank the following compounds in order of decreasing acidity, putting the most acidic first.

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

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

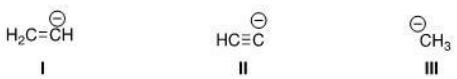


I II III

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa Topic: Acids and Bases

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



I II III

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa Topic: Acids and Bases

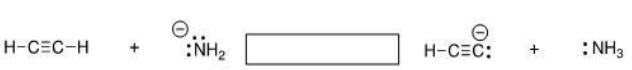
28. Which of the following is the strongest base?

A. CH_3COCH_3
B. CH_3COOH
C. NH_3
D. H_2O

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty:
Medium Gradable: automatic
Section: 02.03

Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa Topic: Acids and Bases

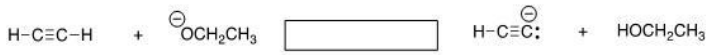
29. What is the direction of equilibrium when acetylene (C_2H_2) reacts with H_2N^- in an acid-base reaction?



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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.04
Subtopic: Factors affecting acid strength Subtopic:
Predicting acid/base reaction equilibrium Topic:
Acids and Bases

30. What is the direction of equilibrium when acetylene (C_2H_2) reacts with ethoxide ($CH_3CH_2O^-$) in an acid-base reaction?



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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.04
Subtopic: Factors affecting acid strength Subtopic: Predicting acid/base reaction equilibrium Topic: Acids and Bases

31. Which of the following statements explains why H_2O is a stronger acid than CH_4?

A. H_2O can form hydrogen bonds while CH_4 cannot.
B. H_2O forms a less stable conjugate base, HO^-.
C. CH_4 forms a more stable conjugate base, CH_3^-.
D. H_2O forms a more stable conjugate base, HO^-.

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05

Subtopic: Factors affecting acid strength
Topic: Acids and Bases

32. Which of the following statements explain why HBr is a stronger acid than HF?

A. Br^- is more stable than F^- because Br^- is larger 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 less stable than F^- because Br^- is less electronegative than F^-.

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05

Subtopic: Factors affecting acid strength
Topic: Acids and Bases

33. Which of the following compounds has the lowest pK_a?

A. H_2O
B. H_2S
C. NH_3
D. CH_4

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: pKa
Topic: Acids and Bases

34. Which of the following concepts can be used to explain the difference in acidity between acetic acid (CH_3COOH) and ethanol (CH_3CH_2OH)?

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

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05

Subtopic: Factors affecting acid strength
Topic: Acids and Bases

35. Which of the following concepts can be used to explain the difference in acidity between acetylene (C_2H_2) and ethylene (C_2H_4)?

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

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05

Subtopic: Factors affecting acid strength
Topic: Acids and Bases

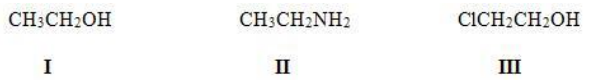
36. Which of the following concepts can be used to explain the difference in acidity between ethanol (CH_3CH_2OH) and 2-fluoroethanol (FCH_2CH_2OH)?

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

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05

Subtopic: Factors affecting acid strength
Topic: Acids and Bases

37. Rank the following compounds in order of decreasing acidity, putting the most acidic first.



I II III

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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.05
Subtopic: Factors affecting acid strength
Topic: Acids and Bases

38. Which of the following statements about Lewis acids is true?

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

Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Easy Gradable: automatic Section: 02.06

Subtopic: Acid/Base definitions
Topic: Acids and Bases

39. Which of the following statements about Lewis bases is true?

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

Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Easy Gradable: automatic Section: 02.06

Subtopic: Acid/Base definitions
Topic: Acids and Bases

40. Which of the following is a Lewis acid but not a Brønsted-Lowry acid?

A. CH_3OH
B. H_2O
C. CH_3COOH
D. BF_3

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.06

Subtopic: Acid/Base definitions
Topic: Acids and Bases

41. Which of the following species can be both Lewis acid and Lewis base?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

42. What is the correct classification of the following compound?
CH_3-O-CH_3

A.
Brønsted-Lowry acid and Lewis acid

B.
Brønsted-Lowry base and Lewis base

C.
Brønsted-Lowry base

D.
Lewis base

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

43. Identify the Lewis acid in the following reaction.

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

44. Identify the Lewis base in the following reaction.

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

45. Which of the following compounds is *not* a Lewis acid?

A. $AlCl_3$
B. HCl
C. H_2O
D. CBr_4

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.06

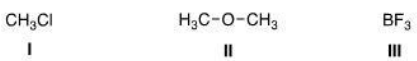
Subtopic: Acid/Base definitions
Topic: Acids and Bases

46. What is the role of methylchloride (CH_3Cl) in the following reaction?

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

Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

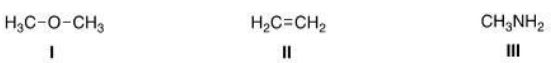
47. What is the electrophilic site in the following compounds?



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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

48. What is the nucleophilic site in the following compounds?



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

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

49. What is the conjugate base of HSO_4^-?

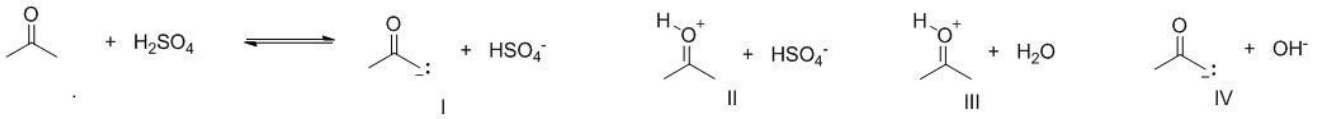
SO_4^{2-} H_2SO_4 SO_3 H_2O
I II III IV

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

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Medium Gradable: automatic Section: 02.06

Subtopic: Acid/Base definitions
Topic: Acids and Bases

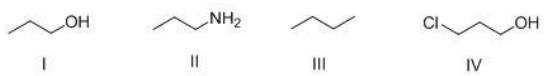
50. What are the products of the following proton transfer reaction?



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

Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 02.04
Subtopic: Predicting acid/base reaction equilibrium
Topic: Acids and Bases

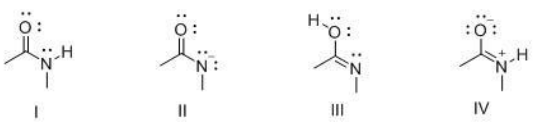
51. What is the correct rank of the following compounds in order of increasing acidity?



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

Bloom's Level: 4. Analyze
Difficulty: Hard
Gradable: automatic
Section: 02.05
Subtopic: Factors affecting acid strength
Topic: Acids and Bases

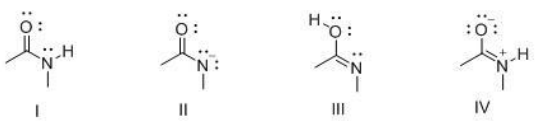
52. Consider the following structures I-IV. Which two species represent a conjugate acid-base pair?



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

Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

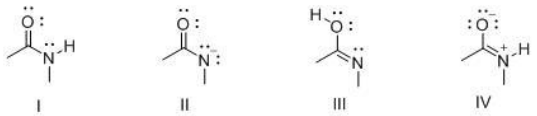
53. Consider the following structures I-IV. Which two species represent resonance structures?



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

Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases

54. Consider the following structures I-IV. Which two species represent constitutional isomers?



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

Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 02.02
Subtopic: Acid/Base definitions
Topic: Acids and Bases