

TEST BANK



ORGANIC CHEMISTRY

Fifth Edition



Mc
Graw
Hill
Education

JANICE GORZYNSKI SMITH



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

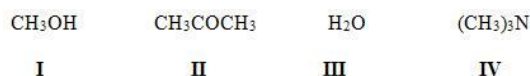
2. Which of the following statements about a Brønsted-Lowry base is true?

- 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?



- 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^{3-}
- 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, CH₃OH?

- A. CH₃OH₂⁺
- B. CH₃O⁻
- C. CH₃
- D. CH₄

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, H₃O⁺?

- A. H₃O
- B. H₂O⁻
- C. H₂O
- 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, NH₃?

- A. H₄N
- B. H₃N⁺
- C. H₂N⁻
- D. H₄N⁺

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. H₂S
- B. PH₃
- C. HCl
- D. SiH₄

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. H₂N⁻
- C. CH₃COO⁻
- D. Cl⁻

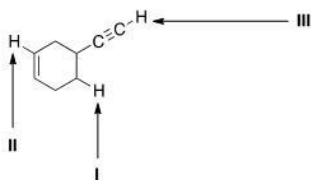
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Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.03
Subtopic: Acid strength of functional groups
Subtopic: Factors affecting acid strength
Subtopic: pKa
Topic: Acids and Bases

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

- A. CH₃NH₂ < CH₃OH < CH₄
- B. CH₃OH < CH₃NH₂ < CH₄
- C. CH₄ < CH₃NH₂ < CH₃OH
- D. CH₄ < CH₃OH < CH₃NH₂

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. $\text{III} < \text{I} < \text{IV} < \text{II}$
B. $\text{III} < \text{IV} < \text{I} < \text{II}$
C. $\text{II} < \text{I} < \text{IV} < \text{III}$
D. $\text{III} < \text{I} < \text{II} < \text{IV}$

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. $\text{I} < \text{IV} < \text{III} < \text{II}$
B. $\text{I} < \text{III} < \text{IV} < \text{II}$
C. $\text{II} < \text{III} < \text{IV} < \text{I}$
D. $\text{II} < \text{IV} < \text{III} < \text{I}$

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. $\text{IV} > \text{II} > \text{III} > \text{I}$
B. $\text{III} > \text{II} > \text{IV} > \text{I}$
C. $\text{I} > \text{II} > \text{IV} > \text{III}$
D. $\text{III} > \text{IV} > \text{II} > \text{I}$

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. $\text{IV} > \text{II} > \text{III} > \text{I}$
B. $\text{IV} > \text{III} > \text{II} > \text{I}$
C. $\text{III} > \text{IV} > \text{II} > \text{I}$
D. $\text{III} > \text{IV} > \text{I} > \text{II}$

Bloom's Level: 3. Apply

Difficulty: Medium

Gradable: automatic

Section: 02.03

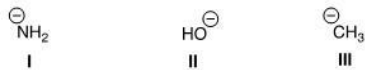
Subtopic: Acid strength of functional groups

Subtopic: Factors affecting acid strength

Subtopic: pKa

Topic: Acids and Bases

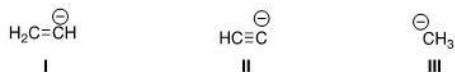
26. Rank the following conjugate bases in order of increasing basicity, putting the least basic first.



- 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.



- 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

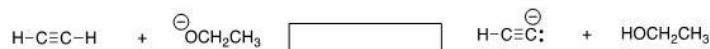
29. What is the direction of equilibrium when acetylene (C_2H_2) reacts with H_2N^- in an acid-base reaction?



- 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

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

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

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: pK_a

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

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

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 ($\text{CH}_3\text{CH}_2\text{OH}$) and 2-fluoroethanol ($\text{FCH}_2\text{CH}_2\text{OH}$)?

- 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

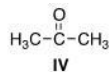
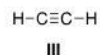
40. Which of the following is a Lewis acid but not a Brønsted-Lowry acid?

- 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

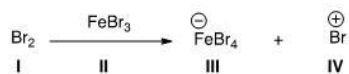
Bloom's Level: 3. Apply
Difficulty: Easy
Gradable: automatic
Section: 02.06
Subtopic: Acid/Base definitions
Topic: Acids and Bases

42. What is the correct classification of the following compound?
 $\text{CH}_3\text{-O-CH}_3$

- 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

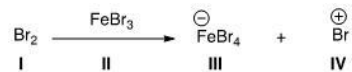
43. Identify the Lewis acid in the following reaction.



- 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

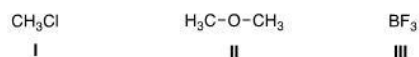
46. What is the role of methylchloride (CH_3Cl) in the following reaction?



- 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

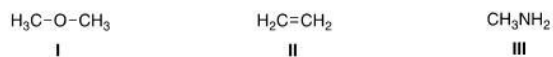
47. What is the electrophilic site in the following compounds?



- 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

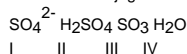
48. What is the nucleophilic site in the following compounds?



- 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^- ?

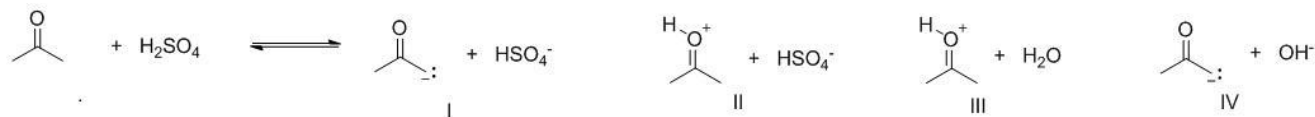


- A. I
- B. II
- C. III
- D. IV

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

Subtopic: Acid/Base definitions
Topic: Acids and Bases

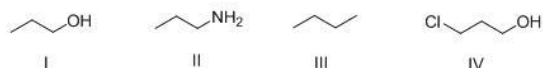
50. What are the products of the following proton transfer reaction?



- 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

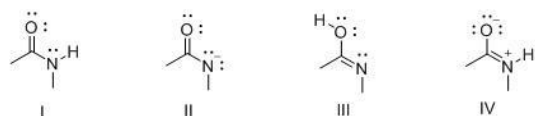
51. What is the correct rank of the following compounds in order of increasing acidity?



- 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

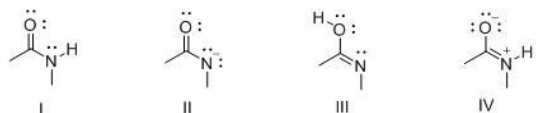
52. Consider the following structures I-IV. Which two species represent a conjugate acid-base pair?



- 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

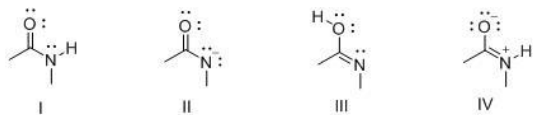
53. Consider the following structures I-IV. Which two species represent resonance structures?



- 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

