CHEMISTRY Finh Edition 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?

В. С.	Proton acceptor Electron pair donor Electron pair accep Proton donor					
						Accessibility: Keyboard Navigati Bloom's Level: I. Rememl Difficulty: Easy Gradab automatic Section: 02.
						Subtopic: Acid/Base definiti Topic: Acids and Bases
2.	Which of the follow	wing statements about	a Brønsted-Lowry	base is true?		
B. C.	All Brønsted-Lowry	y be zero, positive, or r bases contain a lone p bases contain a protoi	pair of electrons or	a π bond.		
D.	The net charge ma	y be zero or positive.				Accessibility: Keyboard Navigati Bloom's Level: 1. Rememl Difficulty: Easy Gradab automatic Section: 02.
						Subtopic: Acid/Base definitie Topic: Acids and Bases
3.	Which of the follow	wing compounds is both	h a Brønsted-Lowr	ry acid and base?		
	CH ₃ OH	CH ₃ COCH ₃	H_2O	(CH ₃) ₃ N		
	I	п	ш	IV		
	I, II I, III					
	II, IV I, IV					
						Bloom's Level: 3. App Difficulty: Ec Gradable: automa Section: 02. Subtopic: Acid/Base definiti
						Topic: Acids and Bases
		wing species cannot ac	ct as both a Brønste	ed-Lowry acid and base?		
	HCO ₃					
C.	HO H ₂ PO ₄					
						Accessibility: Keyboard Wavigail Bloom's Level: 3. Apply Difficul Easy Gradable: automatic Sectic 02.
						Subropic: Acid/Base definiti Topic: Acids and Bases
5.	Which of the follow	wing species is not a B	rønsted-Lowry bas	se?		
B. C.	BF ₃ NH ₃ H ₂ O					
D.	PO ₄					Accessibility: Keyboard Navigati
						Bloom's Level: 3. Apply Difficul Easy Gradable: automatic Sectie 02.
						Subtopic: Acid/Base definitie Topic: Acids and Bases
6.	Which of the follow	wing statements about	Brønsted-Lowry ad	cids and bases is true?		
		om a base forms its cor				
C.	Gain of a proton by	an acid forms its conju	ugate base.	nsfer of a proton from a base to	an acid.	
						Accessibility: Keyboard Navigati Bloom's Level: 3. Apply Difficul Easy Gradable: automatic Sectic 02.
						Subtopic: Acid/Base definiti Topic: Acids and Bases

A. CH ₃ OH ₂ ⁺ B. CH ₃ O C. CH ₃ D. CH ₄	
D. Grig	Accessibility: Keyboard Navigation Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.01 Subtopic: AcidBase definitions Topic: Acids and Bases
8. Which of the following species is the conjugate base of the hydronium ion, H ₃ O ⁺ ?	
A. H ₃ O B. H ₂ O C. H ₂ O D. HO	
	Accessibility: Keyboard Navigation Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.01
9. Which of the following species is the conjugate acid of ammonia, NH ₃ ?	Subtopic: Acid/Base definitions Topic: Acids and Bases
А. H4N В. H ₃ N ⁺	
C. H_2N^{-1} D. H_4N^{+1}	
	Accessibiliy: 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?	
$_{:CH_{3}}^{\ominus}$ + $_{H_{2}O}$ \longrightarrow $_{CH_{4}}$ + $_{HO}^{\ominus}$ $_{IV}$	
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?	
$\stackrel{\bigcirc}{:}$ CH ₃ + H ₂ O $\stackrel{\frown}{\longrightarrow}$ CH ₄ + HO $\stackrel{\bigcirc}{}$ IV	
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

7. Which of the following species is the conjugate base of methanol, CH₃OH?

12. Which is the co	njugate acid in the	following reaction?				
HCI I	+ H ₂ O	-	ol⊝ III	s. f.	H ₃ O •	
A. I B. II C. III D. IV						
						Bloom's Level: 3. App Difficulty: Eas Gradable: automatic Section: 02.0 Subtopic: Acid/ Sage definition Topic: Acid/ sand Bases
13. Which is the co	njugate base in the	e following reaction?				
HCI I	+ H ₂ O	-	→ cı [©]	÷	H ₃ O	
A. I B. II C. III D. IV						
						Bloom's Level: 3. App Difficulty: Eas Gradable: automatic Section: 02.0 Subtopic: Acid/ Sage selfaithion Topic: Acids and Bases
14. Which of the folk A. The stronger the B. The stronger the C. The stronger the D. The stronger the	acid, the further th acid, the smaller t acid, the larger the	ne equilibrium lies to he K _a . e pK _a .				Accessibility: Keyboard Navigatic
						Bloom's Level: 3. App Difficulty: Eas Gradable: automatic Subtopic: Acid strength of functional group Subtopic: Factors affecting acid streng Subtopic: Factors affecting acid streng Topic: Acids and Bas
15. Which of the fol	llowing compounds	s is the strongest aci	d?			
CH₄ I	CH ₃ CH ₃		CH ₂	HC≣CH IV		
A. I B. II C. III D. IV						
						Bloom's Level: 3. App Difficulty: Ear Gradable: automatic Section: 02. Subtopic: Acid strength of functional group Subtopic: Factors affecting acid strengt Subtopic: Pactors of Subtopic: Pactors of
16. Which of the folk	owing compounds	is the strongest acid	?			Topic: Acids and Bas
A. CH ₃ OH B. BrCH ₂ OH C. CH ₃ NH ₂ D. CH ₃ CI	ŭ ,	Č				
-						Accessibility: Keyboard Navigatio Bloom's Level: 3. App Difficulty: Eas

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

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

- A. HF
- B. HCI
- C. HBr

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
- 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. CI

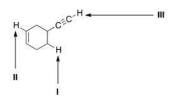
Accessibility: Keyboard Navigation Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.03 Subtopic: Acid strength of functional groups Subtopic: Factors affecting acid strength Subtopic: pKa Topic: Acids and Bases

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

- A. 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.** ||| > || > 1
- D. III > I > II

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

22.				
Rank the following con		sing acidity, putting the least		
CH ₃ COOH	CICH2COOH	CH₃CH2OH	CICH ₂ CH ₂ OH	
I	П	Ш	IV	
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 con	npounds in order of increas	sing acidity, putting the least	acidic first.	
СН₃СООН	FCH ₂ COOH	CICH ₂ COOH	BrCH2COOH	
I	п	ш	IV	
A. < V < < B. < < V < C. < < V < D. < V < <				
				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 con	npounds in order of decrea	sing acidity, putting the most	acidic first.	
CH ₄	NH ₃	HF	H ₂ O	
I	П	Ш	IV	
A. V > > > B. > > V > C. > > V > D. > V > >				
				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 con	npounds in order of decrea	sing acidity, putting the most	acidic first.	
CH ₃ OCH ₃	CH ₃ CHO	CH ₃ CH ₂ OH	СН₃СООН	
I	п	ш	IV	
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		der of increasing basicity, p	outting the least basic firs	t.	
NH ₂	но [©] ∥	CH ₃			
A. < < B. < < C. < <					
D. I < III < II					
					Bloom's Level: 3. Ap Difficulty: Medi Gradable: automa Section: 02 Subtopic: Acid strength of functional gro Subtopic: Factors affecting acid stren Subtopic: Factors affecting acid stren
					Subtopic: pKa Topic: Acids and Ba.
27. Rank the following	g conjugate bases in or	der of decreasing basicity,	putting the most basic fire	st.	
H₂C=CH I	HC≡C II	⊝ CH₃ III			
A. II > I > III					
B. > > C. > > D. > >					
					Bloom's Level: 3. Ap Difficulty: Medi Gradable: automa Section: 02. Subtopic: Acid strength of functional grou Subtopic: Factors affecting acid streng Subtopic: PKa Topic: Acids and Ba:
00 144 1 4 4 4					
28. Which of the follow A. CH3COCH3	ring is the strongest bas	e?			
B. CH ₃ COOH C. NH ₃					
D. H ₂ O					Accessibility: Keyboard Navigati Bloom's Level: 3. Apply Difficul Medium Gradable: automa Section: 02.
					Subtopic: Acid strength of functional grow Subtopic: Factors affecting acid stren Subtopic: pKa Topic: Acids and Bas
29. What is the directi	ion of equilibrium when	acetylene (C2H2) reacts v	vith HɔN ˙ in an acid-base	reaction?	
H-CEC-H	+ :NH ₂	H-C≡	C: + :NH ₃		
A. Left B. Right					
Neither Cannot be determing	ned				Bloom's Level: 3. App Difficulty: Ec
					Gradable: automa Section: 02. Subtopie: Factors affecting acid strength Subbo Predicting acid/base reaction equilibrium Top Acids and Ba:

30. What is the direction of equilibrium when acetylene (C ₂ H ₂) reacts with ethoxide (CH ₃ CH ₂ O) in an acid-base reaction?	
H-C≡C-H + OCH ₂ CH ₃	
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:
31.	Acids and Bases
Which of the following statements explains why H ₂ O is a stronger acid than CH ₄ ?	
 A. H₂O can form hydrogen bonds while CH₄ cannot. B. H₂O forms a less stable conjugate base, HO . C. CH₄ forms a more stable conjugate base, CH₃ . 	
D. H ₂ O 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 pKa?	
A. H ₂ O B. H ₂ S C. NH ₃ D. CH ₄	
J. 5.4	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 ₃ COOH) and ethanol (CH ₃ CH ₂ OH)?	
A. Hybridization B. Electronegativity C. Resonance D. Size	
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 ₂ H ₂) and ethylene (C ₂ H 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

30. Which of the following concep	ots can be used to explain the	unierence in acidity between ethani	
A. Size B. Inductive effect C. Resonance D. Hybridization			
			Accessibility: Keyboard Navigation Bloom's Level: 3. Apply Difficulty: Easy Gradable: automatic Section: 02.05
07			Subtopic: Factors affecting acid strength Topic: Acids and Bases
37. Rank the following compoun	ds in order of decreasing acidi	ity, putting the most acidic first.	
CH ₃ CH ₂ OH	CH ₃ CH ₂ NH ₂	ClCH ₂ CH ₂ OH	
I	П	Ш	
A. > > B. > C. > D. >			
			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 statem	ents about Lewis acids is true'	?	
A. Lewis acids are proton donors B. Lewis acids are proton accept C. Lewis acids are electron pair of	ors. donors.		
D. Lewis acids are electron pair a	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 statem	ents about Lewis bases is true	?	
A. Lewis bases are electron pair B. Lewis bases are electron pair C. Lewis bases are proton donor.	donors. s.		
D. Lewis bases are proton accep	otors.		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 Lev	wis acid but not a Brønsted-Lo	owry acid?	
A. CH3OH			
B. H ₂ O C. CH ₃ COOH			Accessibility: Keyboard Navigation
D. BF3			Accessibility: Aeybodra Naviguion 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?

H ₂ O	CCI ₄	H-CEC-H	O H₃C−Ö−CH₃
1	11	III	IV

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

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

- 42. What is the correct classification of the following compound? $\ensuremath{\text{CH}_3\text{-O-CH}_3}$
- Brønsted-Lowry acid and Lewis acid
- B. Brønsted-Lowry base and Lewis base
- Brønsted-Lowry base
- 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

 $\begin{tabular}{l} 43.\\ \hline \end{tabular}$ 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

Identify the Lewis base in the following reaction.

dentify the Lewis base in the following reaction.

$$Br_2 \xrightarrow{FeBr_3} \xrightarrow{\Theta} FeBr_4 + B$$
I III IV

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

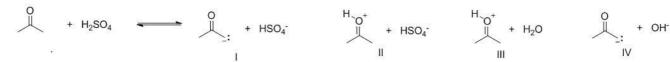
Bloom's Level: 3. Apply Difficulty: Easy Section: 02.06 Subtopic: Acid/Base definitions Topic: Acids and Bases

B. HCI C. H ₂ O D. CBr ₄				
				Accessibility: Keyboard Navigati Bloom's Level: 3. Apply Difficul Easy Gradable: automatic Sectic 02.
46.				Subtopic: Acid/Base definiti Topic: Acids and Bases
What is the role of mo	ethylchloride (CH ₃ Cl) in the	following reaction?		
CH ₃ CI +	AICI ₃	⊕ CH ₃ +	IICI ₄	
A. Lewis acid B. Lewis base C. Brønsted-Lowry acid D. Brønsted-Lowry base				
				Bloom's Level: 3. App Difficulty: Ec
				Gradable: automa Gradable: automa Section: 02. Subtopic: Acid/Base definiti Topic: Acids and Bases
47				
What is the electroph	nilic site in the following comp	pounds?		
CH₃CI I	H ₃ C-O-CH ₃ II	BF ₃		
A. I = Carbon; II = carbon B. I = Chlorine; II = carbo C. I = Carbon; II = oxyger D. I = Carbon; II = carbon	n; III = boron. n; III = boron.			Bloom's Level: 3. App Difficulty: Medit Gradable: automa Section: 02. Subopic: Acid/Base defin Topic: Acids and Bases
48. What is the nucleoph	ilic site in the following comp	oounds?		
H ₃ C-O-CH ₃	H ₂ C=CH ₂		NH ₂	
1	Ш		11	
B. I = Oxygen; II = carborC. I = Hydrogen; II = carb		n.		Bloom's Level: 3. App Difficulty: Medi Gradable: automa Section: 02. Subiopic: Acid/Base defin Topic: Acids and Bases
49. What is the conjugate SO ₄ ²⁻ H ₂ SO ₄ SO ₃ F I II III IV	H ₂ O			
A. I B. II C. III D. IV				Accessibility: Keyboard Navigati Bloom's Level: 4. Analy Difficulty: Medium Gradab automatic Section: 02. Subtopic: Acid/Base definiti
				Topic: Acids and Bases

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

A. AICI3

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



A. I B. II

C. III

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

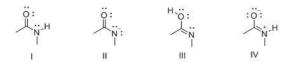
What is the correct rank of the following compounds in order of increasing acidity?



- A. I > II > III > IV
- B. IV > III > II > I
- **C.** IV > I > II > III
- $\mathsf{D.}\ \mathsf{III} > \mathsf{I} > \mathsf{IV} > \mathsf{II}$

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. Land 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

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

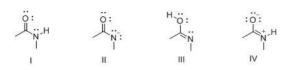




- A. I and II
- B. I and III
- C. I and IV D. II and IV

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