

Acid Unit: Definitions and Properties

1. Which ion is **not amphiprotic**?

a	$\text{HOOC}\text{COO}^- (\text{aq})$
b	$\text{HPO}_4^{2-} (\text{aq})$
c	$\text{H}_2\text{PO}_4^- (\text{aq})$
d	$\text{OOC}\text{COO}^{2-} (\text{aq})$

2. The **net ionic equation** for the reaction that occurs between nitric acid and aqueous potassium hydroxide is _____

a	$\text{HNO}_3(\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow \text{NO}_3^- (\text{aq}) + \text{H}_3\text{O}^+ (\text{aq})$
b	$\text{HNO}_3(\text{aq}) + \text{KOH} \rightarrow \text{KNO}_3(\text{aq}) + \text{H}_2\text{O}(\text{l})$
c	$\text{K}^+ (\text{aq}) + \text{NO}_3^- (\text{aq}) \rightarrow \text{KNO}_3(\text{aq})$
d	$\text{H}_3\text{O}^+ (\text{aq}) + \text{OH}^- (\text{aq}) \rightarrow 2 \text{H}_2\text{O}(\text{l})$

3. If 0.10 mol/L solutions are prepared for each of the following, which will have the highest conductivity?

a	$\text{H}_2\text{S}(\text{aq})$
b	$\text{HOCl}(\text{aq})$
c	$\text{HF}(\text{aq})$
d	$\text{C}_6\text{H}_5\text{COOH}(\text{aq})$

4. A 0.10 mol/L solution of $\text{CH}_3\text{COOH}(\text{aq})$ at 25°C sits in a beaker in the lab. The TRUE statement below is _____

a	there are more ions than molecules in the solution
b	there are more molecules than ions in the solution
c	There are equal numbers of ions and molecules in the solution
d	The $[\text{H}_3\text{O}^+ (\text{aq})]$ is higher than $[\text{CH}_3\text{COO}^- (\text{aq})]$

5. If four acidic solutions of identical concentration are tested for electrical conductivity, which solution would have the **lowest** electrical conductivity?

a	$\text{HCN}(\text{aq})$
b	$\text{H}_2\text{CO}_3 (\text{aq})$
c	$\text{HNO}_2 (\text{aq})$
d	$\text{HNO}_3 (\text{aq})$

6. A neutralization reaction is a reaction between a/an ____ and a/an ____ to form a ____ and ____.

a	Acid	Base	Salt	Water
b	Acid	Metal	Salt	Hydrogen gas
c	Aqueous solution	Aqueous solution	Precipitate	Aqueous solution
d	Oxidizing agent	Reducing agent	Metal	Aqueous solution

7. Milk of magnesia tastes bitter and turns HPh to pink. It is reasonable to conclude that the milk of magnesia could ____

a	Neutralize a solution of NaOH(aq)
b	Neutralize a solution of HCl(aq)
c	Raise the $[H_3O^+(aq)]$
d	Lower the pH of a solution.

8. When used to describe an acid, the word "weak" means that the acid will _____ and exhibit pH that is _____ than expected.

a	Show incomplete dissociation	Lower
b	Show complete dissociation	Lower
c	Show incomplete dissociation	Higher
d	Show complete	Higher

9. A student suspects that an unknown acid of known concentration is diprotic. In order to test this hypothesis, the most useful procedure for the student to follow would be to:

a	Titrate with a strong base of known concentration
b	Determine the molar mass of the acid
c	Find the initial pH of the acid
d	Establish the degree of electrical conductivity.

10. Which polyprotic acid will require the fewest moles of NaOH(aq) to bring the titration to completion?

a	$H_3PO_4(aq)$
b	$H_2S(aq)$
c	$H_2SO_3(aq)$
d	$HOCCOOH(aq)$

11. Four unknown solutions labeled I, II, III, and IV were tested and the following observations were recorded.

Solution	Conductivity	pH
I	Poor	8.1
II	Excellent	1.4
III	Poor	6.1
IV	Excellent	13.7

The strong acid is solution ____, while the weak base is solution ____.

a	II	IV
b	III	I
c	II	IV
d	II	I

12. The strongest acid listed below is _____.

a	$\text{H}_3\text{X(aq)}$
b	$\text{H}_2\text{X(aq)}$
c	HX(aq)
d	$\text{X}^-(\text{aq})$

13. The property that acids and bases have in common is that they

a	Both undergo reduction
b	Both change indicators
c	Both undergo oxidation
d	Both have a high concentration of $[\text{OH}^-(\text{aq})]$

14. When butter goes rancid, it has a sour taste. One should also expect it to

a	Neutralize a solution of HCl(aq)
b	Have a $\text{pH} > 7$
c	React with Zn(s) to form $\text{H}_2(\text{g})$
d	Turn blue in the presence of HbB .

15. If acid HX(aq) is stronger than acid HY(aq) then _____

a	HY(aq) will have a lower pH than HX(aq)
b	HX(aq) will have a lower $[\text{H}_3\text{O}^+(\text{aq})]$ than HY(aq)
c	HY(aq) will have a higher $[\text{OH}^-(\text{aq})]$ than HX(aq)
d	HX(aq) will have a higher pH than HY(aq)

16. What is the essential difference between a 1.0 mol/L solution of a weak acid and a 1.0 mol/L solution of a strong acid?

a	The strong acid can act as a buffer, while the weak acid cannot.
b	The strong acid can undergo a stoichiometric reaction with NaOH(aq) while the weak acid cannot.
c	The strong acid has a lower pH than the weak acid.
d	The weak acid is more dilute than the strong acid.

17. As NaOH(s) is added to HCl(aq) , all of the following changes in solution properties should be observed EXCEPT _____

a	Decrease in temperature
b	Increase in pH
c	Increase in $[\text{OH}^-(\text{aq})]$
d	Decrease in $[\text{H}_3\text{O}^+(\text{aq})]$

18. Which statement about acids is true?

a	Acids increase $[\text{H}_3\text{O}^+(\text{aq})]$
b	Acids increase $[\text{OH}^-(\text{aq})]$
c	Acids accept protons in a chemical reaction.
d	Acids increase the pH of an aqueous solution.

19. When a base is added to an acid, the reaction will show

a	A decrease the pH of an aqueous solution
b	A decrease of $[\text{OH}^-(\text{aq})]$ in the aqueous solution
c	A gain of electrons by the base
d	A gain of protons by the base

20. A student observed that a solution spilled in the garage at home was reacting with a zinc container. The solution could be expected to

a	Be a reducing agent
b	To have a high pH
c	To donate protons
d	To turn HPr red.

21. Some 25 mL portions of 0.10 mol/L solutions of $\text{H}_2\text{SO}_4(\text{aq})$, $\text{HCl}(\text{aq})$ and $\text{CH}_3\text{COOH}(\text{aq})$ are contained in separate, unlabeled flasks. Simple laboratory tests are to be done to identify the solutions. Which test could best identify one of the solutions?

a	The $\text{H}_2\text{SO}_4(\text{aq})$ can be identified by the amount of KOH that will be required to reach an endpoint.
b	The $\text{HCl}(\text{aq})$ can be identified by its reaction with $\text{Mg}(\text{s})$ to produce $\text{H}_2(\text{g})$
c	The $\text{HCl}(\text{aq})$ can be identified by the red colour that results when HMo indicator is added.
d	$\text{CH}_3\text{COOH}(\text{aq})$ can be identified as having the lowest pH.

22. A student observed that a solution spilled in the garage at home reacted with a zinc container. The correct statement regarding the solution is _____

a	the solution is a reducing agent
b	the solution turns phenol red to a yellow colour
c	Accepting protons
d	the solution is undergoing oxidation

23. Numerical response question

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Left justify your answer in the boxes provided.

Consider the list of reactants below

1. $\text{HCl}_{(\text{aq})}$ and $\text{NaOH}_{(\text{s})}$
2. $\text{CH}_3\text{COOH}_{(\text{aq})}$ and $\text{NaCH}_3\text{COO}_{(\text{aq})}$
3. $\text{HNO}_{3(\text{aq})}$ and $\text{NaNO}_{3(\text{aq})}$
4. $\text{NaH}_2\text{PO}_{4(\text{aq})}$ and $\text{Na}_2\text{HPO}_{4(\text{aq})}$
5. $\text{H}_2\text{CO}_{3(\text{aq})}$ and $\text{NaHCO}_{3(\text{aq})}$
6. $\text{HBr}_{(\text{aq})}$ and $\text{Na}_2\text{CO}_{3(\text{aq})}$

Choose the combination of chemical compounds that will act as buffers. Put the answer(s) in ascending order.

Solutions:

1. D
2. D
3. C
4. B
5. A
6. A
7. B
8. C
9. A
10. B
11. D
12. A
13. B
14. C
15. C
16. C
17. A
18. A
19. D
20. C
21. A
22. B
23. 245