



Acid Base Practice Test Questions

Question 01

In a sample of pure water, only one of the following statements is **always** true at all conditions of temperature and pressure.

Which one is always true?

- a) $[\text{H}_3\text{O}^+] = 1.0 \times 10^{-7} \text{ M}$
- b) The density of water is 1.0 g/mL
- c) $\text{pH} = 7.0$
- d) $[\text{H}_3\text{O}^+] = [\text{OH}^-]$

Question 02

At 25 °C, the pH of pure water is 7.0. However at 38 °C, the pH lowers to 6.8. Which explanation accounts for this effect?

- a) At higher temperatures, water becomes naturally acidic.
- b) The autoionization constant for water, K_w , increases at higher temperatures.
- c) The autoionization constant for water, K_w , decreases at higher temperatures.
- d) The concentration of H^+ ions of pure water increases compared to the concentration of OH^- ions at 38 °C.

Question 03

In the equation: $\text{HF} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{F}^-$

- a) HF is an acid and F^- is its conjugate base.
- b) HF is a base and H_3O^+ is its conjugate acid.
- c) HF is a base and F^- is its conjugate acid.
- d) H_2O is a base and HF is its conjugate acid.
- e) H_2O is an acid and HF is the conjugate base.

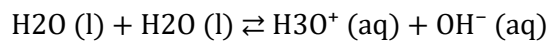
Question 04

HF (aq) reacts with NH_3 (aq) in an acid-base proton transfer reaction. Which of the following correctly identifies a conjugate acid-base pair in the solution made by mixing these two chemicals?

- a) The acid is HF (aq) and the conjugate base is NH_3 (aq).
- b) The acid is NH_3 (aq) and the conjugate base is NH_4^+ (aq)
- c) The acid is HF (aq) and the conjugate base is F_- (aq).
- d) The acid is NH_4^+ and the conjugate base is F_- (aq).

Question 05

The auto-ionization reaction for water is shown in the reaction below. The associated values of pK_w at different temperatures are shown in the table. Which of the following statements is valid based on the data from the table?



Temperature (°C)	pK _w
0	14.9
10	14.5
20	14.2
25	14.0
30	13.8
40	13.5
50	13.3

- a) The autoionization of water is an exothermic process.
- b) The pH of pure water is always 7.0.
- c) The pH of pure water is below 7.0 at temperatures above 25°C.
- d) The pH of pure water is above 7.0 at temperatures above 25°C.

**Question 06**

Based on the acid-base reaction and equilibrium constant above, which species is the strongest acid?



- a) HX
- b) Y⁻
- c) HY
- d) X⁻

Question 07

A weak base has a K_b value of 4×10^{-5} . The pH of a 0.10 M solution of the weak base is in which pH range?

- a) 2-3
- b) 5-6
- c) 7-8
- d) 11-12

Question 08

What is the concentration of an HCN solution that will yield a pH = 5.0?

(For HCN, $K_a = 4.0 \times 10^{-10}$.)

- a) 0.10 M
- b) 0.25 M
- c) 0.40 M
- d) 0.50 M

Question 09

What must be done to change 10.0 mL of an HCl solution with a pH of 2.00 into a pH of 4.00?

- a) Add 10.0 mL of distilled water so that the total volume of solution is doubled.
- b) Add distilled water until the total volume is 100.0 mL.
- c) Add distilled water until the total volume is 1.00 L.
- d) Add 10.0 mL of 1.0 M HCl.

**Question 10**

When dissolved in water, one of the salts below produces a basic solution. Which net ionic equation shows the formation of the basic solution when the basic salt is dissolved in water?

Salt 1: NH_4Br Salt 2: $\text{NaC}_2\text{H}_3\text{O}_2$

- a) $\text{NH}_4^+ (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{H}_3\text{O}^+ (\text{aq}) + \text{NH}_3 (\text{aq})$
- b) $\text{Br}^- (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{HBr} (\text{aq}) + \text{OH}^- (\text{aq})$
- c) $\text{Na}^+ (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{OH}^- (\text{aq}) + \text{NaH} (\text{aq})$
- d) $\text{C}_2\text{H}_3\text{O}_2^- (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{HC}_2\text{H}_3\text{O}_2 (\text{aq}) + \text{OH}^- (\text{aq})$

Question 11

What is the pH of a 0.10 M solution of $\text{Ba}(\text{OH})_2$ at 25°C?

- a) 1.00
- b) 0.70
- c) 13.00
- d) 13.30

Question 12

What is the hydroxide ion concentration $[\text{OH}^-]$ at 25°C of an aqueous solution if its pH = 10?

- a) $1 \times 10^{-14} \text{ M}$
- b) $1 \times 10^{-10} \text{ M}$
- c) $1 \times 10^{-4} \text{ M}$
- d) 1.0 M

Question 13

Select the statement which identifies the strongest acid of those shown in the table below and gives the correct reasoning for this determination.

- a) HOCl is the strongest acid due to the electronegativity of the chlorine atom.
- b) HOCl is the strongest acid due to the small atomic radius of the chlorine atom.
- c) HOI is the strongest acid due to the electronegativity of the iodine atom.
- d) HOI is the strongest acid due to the small atomic radius of the iodine atom.

Acid	Structure
HClO	$\text{H} - \ddot{\text{O}} - \ddot{\text{Cl}}:$
HBrO	$\text{H} - \ddot{\text{O}} - \ddot{\text{Br}}:$
HIO	$\text{H} - \ddot{\text{O}} - \ddot{\text{I}}:$

Question 14

Which of the following acids is the strongest acid?

HF ($K_a = 6.8 \times 10^{-4}$)

HClO ($K_a = 3.0 \times 10^{-8}$)

HNO₂ ($K_a = 4.5 \times 10^{-4}$)

HCN ($K_a = 4.9 \times 10^{-10}$)

Question 15

Given the following list of acids and their acid dissociation constants, select the strongest base.

HF ($K_a = 6.8 \times 10^{-4}$)

HClO ($K_a = 3.0 \times 10^{-8}$)

HNO₂ ($K_a = 4.5 \times 10^{-4}$)

HCN ($K_a = 4.9 \times 10^{-10}$)

- a) F⁻
- b) ClO⁻
- c) NO₂⁻
- d) CN⁻

**Question 16**

Which of the solutions listed contains the lowest concentration of hydronium, H_3O^+ ?

- a) A solution where the $\text{pH} = 4.0$
- b) A solution where the $\text{pOH} = 11.0$
- c) A 1.0×10^{-5} M solution of HCl
- d) Pure, distilled water at 25°C

Question 17

HNO_2 is a weak acid with an acid dissociation constant of $K_a = 4.0 \times 10^{-4}$. What is the approximate percent ionization of a 0.10 M solution of HNO_2 (aq)?

- a) 0.040 %
- b) 0.40 %
- c) 0.63 %
- d) 6.3 %

Question 18

What is the concentration of a sodium acetate ($\text{NaC}_2\text{H}_3\text{O}_2$) solution if the pH of the solution is 9.20? The K_a for $\text{HC}_2\text{H}_3\text{O}_2 = 1.8 \times 10^{-5}$

- a) 0.000014 M
- b) 0.068 M
- c) 0.32 M
- d) 0.46 M

Question 19

Based on the K_a and K_b value of the weak acids and weak bases listed, which of the following has the highest pH ?

HCN (aq)	$K_a = 4.9 \times 10^{-10}$
$\text{HC}_2\text{H}_3\text{O}_2$ (aq)	$K_a = 1.8 \times 10^{-5}$
CH_3NH_2 (aq)	$K_b = 4.4 \times 10^{-4}$
$\text{C}_5\text{H}_5\text{N}$ (aq)	$K_b = 1.7 \times 10^{-9}$

- a) HCN
- b) $\text{HC}_2\text{H}_3\text{O}_2$
- c) CH_3NH_2
- d) $\text{C}_5\text{H}_5\text{N}$

**Question 20**

What is the approximate range for a 1.0 M solution of HNO_2 (aq) if the acid dissociation constant for HNO_2 is $K_a = 4.0 \times 10^{-4}$?

- a) Between 0 and 1
- b) Between 1 and 2
- c) Between 2 and 3
- d) Between 3 and 4

Question 21

Which is the **strongest** acid?

- a) HBrO_4
- b) HBrO_3
- c) HBrO_2
- d) HBrO

Question 22

What is the pH of 500.0 mL of solution containing 0.0148 grams of $\text{Ca}(\text{OH})_2$?

- a) 10.30
- b) 10.60
- c) 10.90
- d) 11.02

Question 23

A 0.10 M solution of a weak acid, HX, is 0.060 % ionized. Evaluate K_a for the acid.

- a) 6.0×10^{-3}
- b) 3.6×10^{-4}
- c) 3.6×10^{-6}
- d) 3.6×10^{-8}

Question 24

What is the pH of 0.060 M NH_4Cl ? The K_b for NH_3 is 1.8×10^{-5} .

- a) 5.12
- b) 5.18
- c) 5.24
- d) 5.36

**Question 25**

Identify the stronger acid between H_2S and H_2Se and select the statement which gives the correct reasoning for this distinction.

- a) H_2S is the stronger acid due to the greater electronegativity of the sulfur atom compared to the selenium atom.
- b) H_2S is the stronger acid due to the smaller atomic radius of the sulfur atom compared to the selenium atom.
- c) H_2Se is the stronger acid due to the lower electronegativity of the selenium atom compared to the sulfur atom.
- d) H_2Se is the stronger acid due to the larger atomic radius of the selenium atom compared to the sulfur atom.

Question 26

What is the conjugate acid of CH_3NH^- ?

- a) CH_3N_2^-
- b) CH_3NH_2
- c) CH_3NH_3^+
- d) H_3O^+

Question 27

The K_a for HF is 6.8×10^{-4} . What is the value of K_b for NaF?

- a) 2.0×10^{-8}
- b) 1.5×10^{-11}
- c) 7.0×10^{-18}
- d) 1.5×10^{-10}

Question 28

Which of these acids is most likely the **weakest** acid?

- a) HBr
- b) H_3PO_4
- c) H_2PO_4^-
- d) HPO_4^{2-}

Question 29

Which one of the following 0.1 M solutions would have a pH of 7.0?

- a) Na_2S
- b) AlCl_3
- c) NaNO_3
- d) NH_4Cl
- e) None of these

Question 30

Rank the following in order of base strength using the K_a values given:

NH_3 , OH^- , $\text{C}_2\text{H}_3\text{O}_2^-$, HSO_4^-

K_a of $\text{NH}_4^+ = 5.6 \times 10^{-10}$

K_a of $\text{HC}_2\text{H}_3\text{O}_2 = 1.8 \times 10^{-5}$

- a) $\text{OH}^- > \text{NH}_3 > \text{C}_2\text{H}_3\text{O}_2^- > \text{HSO}_4^-$
- b) $\text{OH}^- > \text{NH}_3 > \text{HSO}_4^- > \text{C}_2\text{H}_3\text{O}_2^-$
- c) $\text{OH}^- > \text{C}_2\text{H}_3\text{O}_2^- > \text{NH}_3 > \text{HSO}_4^-$
- d) $\text{HSO}_4^- > \text{C}_2\text{H}_3\text{O}_2^- > \text{NH}_3 > \text{OH}^-$
- e) None of the above

Question 31

The pH of a solution of HBr is 2.70. What is the concentration of HBr for this solution?

- a) $2.0 \times 10^{-3} \text{ M}$
- b) $2.5 \times 10^{-3} \text{ M}$
- c) $5.0 \times 10^{-12} \text{ M}$
- d) $4.0 \times 10^{-12} \text{ M}$

Question 32

What is the $[\text{OH}^-]$ concentration of a solution with $\text{pH} = 9.50$?

- a) $3.2 \times 10^{-5} \text{ M}$
- b) $8.2 \times 10^{-9} \text{ M}$
- c) $8.3 \times 10^{-10} \text{ M}$
- d) $3.2 \times 10^{-10} \text{ M}$
- e) none of the above