

- Calculate the pH of a 0.020 M solution of lactic acid, $\text{HC}_3\text{H}_5\text{O}_3$, at 25 °C. The $\text{p}K_a$ of lactic acid is 3.86.

pH =

A 1.0 L solution of 0.020 M lactic acid is added to 1.0 L of 0.020 M sodium hydroxide solution. Write the ionic equation for the reaction that occurs.

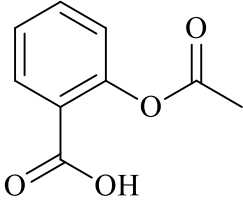
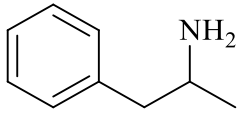
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Is the resulting solution acidic, basic or neutral? Give a reason for your answer.

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Marks
7

- The structures of the drugs aspirin and amphetamine are shown below.
 - Draw the conjugate base of aspirin and the conjugate acid of amphetamine.
 - Circle the form of each that will be present in a highly acidic environment.

 <p style="text-align: center;">aspirin</p>	conjugate base of aspirin
 <p style="text-align: center;">amphetamine</p>	conjugate acid of amphetamine

Ions are less likely to cross cell membranes than uncharged molecules. One of the drugs above is absorbed in the acid environment of the stomach and the other is absorbed in the basic environment of the intestine. Identify which is absorbed in each environment below and *briefly* explain your answers.

Drug absorbed in the stomach:

aspirin / amphetamine

Drug absorbed in the intestine:

aspirin / amphetamine

THIS QUESTION CONTINUES ON THE NEXT PAGE.

Calculate the pH of a 0.010 M solution of aspirin at 25 °C. The pK_a of aspirin is 3.5 at this temperature.

Marks
7

pH =

Aspirin, $C_9H_8O_4$ is not very soluble. “Soluble aspirin” can be made by reacting aspirin with sodium hydroxide. Write the chemical equation for this reaction.

Is a solution of “soluble aspirin” acidic or basic? Briefly explain your answer.

Marks
6

- Solution A consists of a 0.050 M aqueous solution of benzoic acid, C_6H_5COOH , at 25 °C. Calculate the pH of Solution A. The pK_a of benzoic acid is 4.20.

pH =

What are the major species present in solution A?

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Solution B consists of a 0.050 M aqueous solution of ammonia, NH_3 , at 25 °C. Calculate the pH of Solution B. The pK_a of NH_4^+ is 9.24.

pH =

What are the major species present in solution B?

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THIS QUESTION CONTINUES ON THE NEXT PAGE.

Marks
5

Write the equation for the reaction that occurs when benzoic acid reacts with ammonia?

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Write the expression for the equilibrium constant for the reaction of benzoic acid with ammonia?

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What is the value of the equilibrium constant for the reaction of benzoic acid with ammonia? Hint: multiply the above expression by $[H^+]/[H^+]$.

Answer:

What are the major species in the solution that results from adding together equal amounts of solutions A and B?

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- Conjugate acid/base pairs exist in aqueous solutions of weak acids. What is the difference between a weak acid and its conjugate base?

How are the strength of a weak acid and its conjugate base related?

From the following list select 2 conjugate acid/base pairs. Identify acid and base in both pairs.



Marks
6

- You have completed a number of acid/base titrations during your laboratory work. What is the difference between the 'end point' and the 'equivalence point' in an acid/base titration?

How do you determine the concentration of a weak acid through titration with a strong base? Include all necessary steps in your explanation.

How do you determine the pK_a of a weak acid through titration with a strong base? Include all necessary steps in your explanation.

- You have completed a number of titrations during your laboratory work. What is the difference between the 'end point' and the 'equivalence point' in a titration?

4

How do you need to consider that distinction when you chose an indicator for a particular titration?

<ul style="list-style-type: none">Calculate the pH of a 0.020 M solution of $\text{Ba}(\text{OH})_2$.	Marks 1
<p style="text-align: right;">pH =</p>	
<ul style="list-style-type: none">Calculate the pH of a 0.150 M solution of HNO_2. The $\text{p}K_a$ of HNO_2 is 3.15.	3
<p style="text-align: right;">pH =</p>	
<ul style="list-style-type: none">Calculate the pH of a solution that is 0.080 M in acetic acid and 0.160 M in sodium acetate. The $\text{p}K_a$ of acetic acid is 4.76.	2
<p style="text-align: right;">pH =</p>	

Marks
8

- Solution A consists of a 0.50 M aqueous solution of HF at 25 °C. Calculate the pH of Solution A. The pK_a of HF is 3.17.

pH =

At 25 °C, 1.00 L of Solution B consists of 12.97 g of lithium fluoride, LiF, dissolved in water. Calculate the pH of Solution B.

pH =

Solution B (1.00 L) is poured into Solution A (1.00 L) and allowed to equilibrate at 25 °C. Calculate the pH of the final solution.

pH =

If you wanted to adjust the pH of the mixture of Solution A and Solution B to be exactly equal to 4.00, which component in the mixture would you need to increase in concentration?

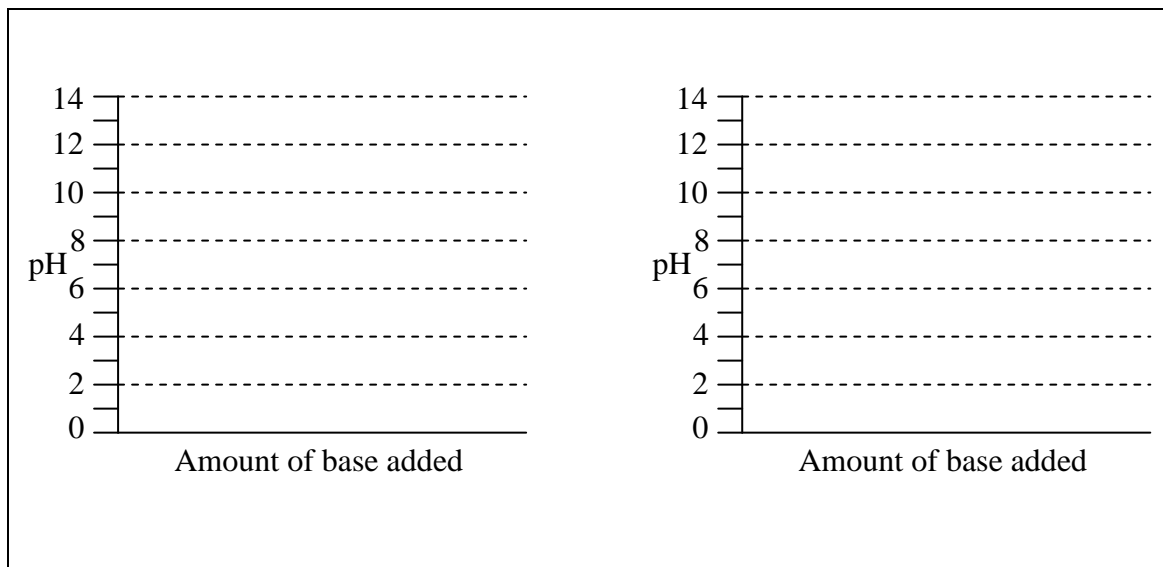
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- Briefly explain why H_2S is a stronger Brønsted acid than H_2O .

Marks
2

Marks
7

- The titration curves for a titration of a weak acid with a strong base and for a strong acid with a strong base are distinctly different. Draw a diagram for each case.



List the main differences.

Explain these differences.

- What is the difference between the 'end point' and the 'equivalence point' in a titration.

2

Marks
2

- What is the pH of a 0.020 M solution of HF? The pK_a of HF is 3.17.

pH =

2

- What is the pH of a solution that is 0.075 M in acetic acid and 0.150 M in sodium acetate? The pK_a of CH_3COOH is 4.76.

pH =

2

- What is the pH of a 0.010 M solution of $Ba(OH)_2$?

pH =

- Describe the difference between a strong and a weak acid.

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Describe in qualitative terms how the percentage ionisation of a weak acid changes when an aqueous solution of the weak acid is diluted.

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Which chemical principle can be used to explain the change in percentage ionisation of a weak acid on dilution and how?

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	Marks
<ul style="list-style-type: none">What is the pH of a 0.010 M solution of $\text{Ca}(\text{OH})_2$? <div data-bbox="705 555 1316 627" style="border: 1px solid black; padding: 5px; text-align: right;">pH =</div>	2
<ul style="list-style-type: none">What is the pH of a 0.010 M solution of HNO_2? The $\text{p}K_a$ of HNO_2 is 3.15. <div data-bbox="705 1288 1316 1355" style="border: 1px solid black; padding: 5px; text-align: right;">pH =</div>	2
<ul style="list-style-type: none">What is the pH of a solution that is 0.020 M in CH_3COOH and 0.010 M in CH_3CO_2^-? The K_a of CH_3COOH is 1.8×10^{-5} M. <div data-bbox="705 1948 1316 2016" style="border: 1px solid black; padding: 5px; text-align: right;">pH =</div>	2

Marks
8

- Solution A consists of a 0.15 M aqueous solution of nitrous acid (HNO_2) at 25 °C. Calculate the pH of Solution A. The $\text{p}K_a$ of HNO_2 is 3.15.

pH =

At 25 °C, 1.00 L of Solution B consists of 13.8 g of sodium nitrite (NaNO_2) dissolved in water. Calculate the pH of Solution B.

pH =

Solution B (1.00 L) is poured into Solution A (1.00 L) and allowed to equilibrate at 25 °C. Calculate the pH of the final solution.

pH =

If you wanted to adjust the pH of the mixture of Solution A and Solution B to be exactly equal to 3.00, which component in the mixture would you need to increase in concentration?