

Key concept (age 11-14)

CSU3.1: pH scale

Progression toolkit: pH scale

Learning focus	Acidic and alkaline solutions may be compared using the pH scale.				
As students' conceptual understanding progresses they can:					
Diagnostic questions	Identifying acids	Identifying alkalis	Indicators	pH scale	Comparing pH
Response activities		Drain cleaner		Which pH?	Unusual scales
As students' conceptual understanding progresses they can:	Describe how to find out, safely, whether a solution is an acid.	Identify and give examples of alkalis.	Describe what information an indicator provides.	Interpret the pH scale	Compare acidity or alkalinity using the pH scale. B

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<p>Identifying acids</p> <p>BEST STUDENT WORKSHEET</p> <p>Identifying acids</p> <p>Some students are discussing what is distinctive about an acid.</p> <p>Molly: Acids burn you.</p> <p>Tim: Acids melt metals.</p> <p>Alina: Acids taste sharp like vinegar and lemon juice.</p> <p>Jerry: Acids eat materials away.</p> <p>Phil: Acids turn litmus indicator red.</p> <p>1. Who do you agree with, and why? 2. How could you find out safely whether a solution is an acid?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>Identifying alkalis</p> <p>BEST STUDENT WORKSHEET</p> <p>Identifying alkalis</p> <p>An unknown solution was poured into a test tube. The red litmus paper turned blue.</p> <p>1. What type of solution is in the test tube? Put a tick (✓) in the box next to the best answer.</p> <p>A acid <input type="checkbox"/> B alkali <input type="checkbox"/></p> <p>2. Which of the following solutions could be inside the test tube? For each statement, tick (✓) how often you think it is true.</p> <table border="1"> <thead> <tr> <th></th> <th>I am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>I am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A vinegar</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B bicarbonate of soda</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C ammonia</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D sodium chloride solution</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>E sodium hydroxide solution</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>1. Who do you agree with, and why?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A vinegar					B bicarbonate of soda					C ammonia					D sodium chloride solution					E sodium hydroxide solution					<p>Indicators</p> <p>BEST STUDENT WORKSHEET</p> <p>Indicators</p> <p>Some students are discussing indicators.</p> <p>Tyler: An indicator tells you whether a solution is an acid or alkali.</p> <p>Jahan: An indicator releases a red colour from acids (and blue from alkalis).</p> <p>Larry: Different indicators change colour at different pH levels.</p> <p>Paul: Indicators make an acid react with an alkali.</p> <p>1. Who do you agree with, and why?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>pH scale</p> <p>BEST STUDENT WORKSHEET</p> <p>pH scale</p> <p>Some students are discussing what the pH of a solution tells you.</p> <p>Monica: pH tells you how acidic a solution is.</p> <p>Priyanka: pH tells you the strength of an acid or alkali.</p> <p>Lucy: The lower the pH, the more dangerous the solution.</p> <p>Chantelle: pH tells you how acidic or alkaline a solution is.</p> <p>1. Who do you agree with, and why?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>Comparing pH</p> <p>BEST STUDENT WORKSHEET</p> <p>Comparing pH</p> <p>Solution X Solution Y</p> <p>pH 2 pH 1</p> <p>How does the acidity of the two solutions compare? Put a tick (✓) in the box next to the best answer.</p> <p>A Solution Y is half as acidic as solution X. <input type="checkbox"/> B Solution Y is twice as acidic as solution X. <input type="checkbox"/> C Solution Y is 10 times as acidic as solution X. <input type="checkbox"/> D Solution Y is a tenth as acidic as solution X. <input type="checkbox"/></p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>
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<p>Drain cleaner</p> <p>BEST TEACHER NOTES</p> <p>Drain cleaner</p> <p>Sometimes chemicals are poured down the drain to get rid of any blockages. Caustic soda is a type of drain cleaner. It is corrosive. DO NOT test or use drain cleaner yourself.</p> <p>Some students are discussing whether caustic soda is an acid or alkali.</p> <p>Freddie: It must be an acid because it is corrosive.</p> <p>Sami: I think it is an alkali because it is a type of cleaning product.</p> <p>Angelica: It must be an acid because it can eat away blockages.</p> <p>Dexter: I think it is an acid because acids are stronger than alkalis.</p> <p>Claudia: I can't tell whether it is an acid or an alkali. I need more information.</p> <p>1. Who do you agree with and why?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	<p>Which pH?</p> <p>BEST STUDENT WORKSHEET</p> <p>Which pH?</p> <p>A student took the pH of 6 different solutions. The results are shown below.</p> <table border="1"> <thead> <tr> <th>Solution</th> <th>pH</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>4</td> </tr> <tr> <td>3</td> <td>7</td> </tr> <tr> <td>4</td> <td>10</td> </tr> <tr> <td>5</td> <td>13</td> </tr> <tr> <td>6</td> <td>14</td> </tr> </tbody> </table> <p>1. Write down the letter of the solution that matches each statement below.</p> <p>A solution that is more acidic than B. A solution that is more alkaline than E. The least acidic solution. The least alkaline solution.</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>	Solution	pH	1	1	2	4	3	7	4	10	5	13	6	14	<p>Unusual scales</p> <p>BEST STUDENT WORKSHEET</p> <p>Unusual scales</p> <p>Richter scale</p> <p>Scientists describe the magnitude (strength) of an earthquake using the Richter Scale. The scale of numbers is unusual because an earthquake which measures 3 on the scale is not double the magnitude of an earthquake of measuring 1. It is 10 times the magnitude.</p> <p>Worked example</p> <p>How many greater is a magnitude 8 earthquake than a magnitude 6 one? 6 - 2 = 4 A magnitude 8 earthquake is 10⁴ = 10,000 times greater than an earthquake of size 6.</p> <p>Practice questions</p> <p>1 How many greater is a magnitude 6 earthquake than an earthquake that has magnitude 3? 2 How many greater is a magnitude 7 earthquake than an earthquake that has magnitude 5?</p> <p>pH scale</p> <p>The pH scale works in two directions.</p> <p>Worked example</p> <p>pH 1 is 10 times more acidic than pH 2. pH 14 is 10 times more alkaline than pH 13.</p> <p>Worked example</p> <p>How much less acidic is pH 4 than pH 3? pH 3 is ten times more acidic than pH 4 so pH 4 is ten times less acidic than pH 3 (or a tenth as acidic).</p> <p>Practice questions</p> <p>1 How much more acidic is pH 1 than pH 4? 2 How much more alkaline is pH 14 than pH 12? 3 How much less acidic is pH 6 than pH 5? 4 How much less alkaline is pH 9 than pH 12?</p> <p><small>Developed by the University of York Science Education Group and the Salters' Institute. This document may have been edited. Download the original from www.BestEvidenceScienceTeaching.org. © University of York Science Education Group. Distributed under a Creative Commons Attribution-NonCommercial (CC BY-NC) license.</small></p>																		
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