

Key concept (age 11-14)

CCR4.1: Neutralisation

Progression toolkit: Neutralisation

Learning focus	A salt is formed from a neutralisation reaction between an acid and a base.				
As students' conceptual understanding progresses they can:	CONCEPTUAL PROGRESSION				
	Explain the appearance of bubbles when bicarbonate of soda reacts with vinegar. P	Explain what happens when an acid appears to 'eat away' a material. P	Suggest evidence that an acid has reacted with an alkali.	Predict the pH at the end of a reaction between an acid and an insoluble base.	Describe the end point of a reaction between a strong acid and a strong alkali. B
Diagnostic questions	Vinegar fizz	Damaged marble	Reaction evidence	Final pH	End point
Response activities	Carbon dioxide possibility	Describing reactions	Reactant and product pH	Beaker contents	Changing pH

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

<p style="text-align: center;">Vinegar fizz</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Vinegar fizz</p> <p>Some bicarbonates of soda ("bairns") is added to a test tube containing vinegar. It bubbles up. Explain how the bubbles are made.</p> <p>For each statement, tick (✓) any columns to show what you think.</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 A gas escapes from the "bairns".</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B A gas is released from the vinegar.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C A new substance in the gas state is made.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D The vinegar changes into the gas state.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A A gas escapes from the "bairns".					B A gas is released from the vinegar.					C A new substance in the gas state is made.					D The vinegar changes into the gas state.					<p style="text-align: center;">Damaged marble</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Damaged marble</p> <p>Acid-based cleaning products should never be used on a marble surface. Some students investigate why.</p> <p>The students place a piece of marble in a test tube containing a hydrochloric acid. Bubbles are formed. The marble gets smaller.</p> <p>Put a lid (✓) in the box next to the best answer.</p> <table border="1"> <tbody> <tr> <td>A The marble dissolves in the acid.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>B The acid eats away the marble.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>C A chemical reaction forms a new soluble substance.</td> <td><input type="checkbox"/></td> </tr> <tr> <td>D The marble changes into the gas state.</td> <td><input type="checkbox"/></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>	A The marble dissolves in the acid.	<input type="checkbox"/>	B The acid eats away the marble.	<input type="checkbox"/>	C A chemical reaction forms a new soluble substance.	<input type="checkbox"/>	D The marble changes into the gas state.	<input type="checkbox"/>	<p style="text-align: center;">Reaction evidence</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Reaction evidence</p> <p>Some copper carbonate is added to some sodium hydroxide solution (an alkali). The chemical equation for the reaction is:</p> $\text{CuCO}_3 + \text{NaOH} \rightarrow \text{Na}_2\text{CO}_3 + \text{Cu(OH)}_2$ <p>For this reaction, what provides evidence of a chemical reaction?</p> <p>For each statement, tick (✓) any columns to show what you think.</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 Change in temperature</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B Formation of bubbles</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C Change in pH</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D Change in colour</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A Change in temperature					B Formation of bubbles					C Change in pH					D Change in colour					<p style="text-align: center;">Final pH</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Final pH</p> <p>Some copper carbonate is added to sulfuric acid. Eventually no more copper carbonate reacts. The excess copper carbonate can be seen at the bottom of the beaker.</p> <p>What is the final pH of the solution?</p> <p>For each statement, tick (✓) any columns to show what you think.</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 pH5</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B pH7</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C pH12</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D No pH</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A pH5					B pH7					C pH12					D No pH					<p style="text-align: center;">End point</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>End point</p> <p>50cm³ of hydrochloric acid is added to a beaker. Sodium hydroxide solution is gradually added. The end point of the reaction is reached when the sodium hydroxide has reacted exactly with the hydrochloric acid. The chemical equation for the reaction is:</p> $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$ <p>Which of the following statements describe when the end point is reached?</p> <p>For each statement, tick (✓) any columns to show what you think.</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 50cm³ of sodium hydroxide solution has been added.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B the pH reaches 7.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C the beaker contains only sodium chloride solution.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>		I am sure this is right	I think this is right	I think this is wrong	I am sure this is wrong	A 50cm ³ of sodium hydroxide solution has been added.					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<p style="text-align: center;">Carbon dioxide possibility</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Carbon dioxide possibility</p> <p>All the substances listed below react with acids.</p> <p>magnesium (Mg) copper carbonate (CuCO₃) copper oxide (CuO)</p> <p>Which substance (or substances) do not produce carbon dioxide when reacted with acid? Explain your answer.</p> <p>If carbon dioxide is not produced, would another substance in the gas state be made?</p> <p style="text-align: right;">1</p>	<p style="text-align: center;">Describing reactions</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Describing reactions</p> <p>Write down what would be observed for each reaction. Use the following words to help you.</p> <p>colourless solution white solid colourless liquid colourless gas (bubbles) white precipitate</p> <p>a calcium carbonate + hydrochloric acid</p> $\text{CaCO}_3(\text{s}) + \text{HCl(aq)} \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g})$ <p>b sodium carbonate + calcium chloride solution</p> $\text{Na}_2\text{CO}_3(\text{aq}) + \text{CaCl}_2(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + 2\text{NaCl(aq)}$ <p style="text-align: right;">1</p>	<p style="text-align: center;">Reactant and product pH</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Reactant and product pH</p> <p>Hydrochloric acid reacts with sodium hydroxide forming sodium chloride and water. The chemical equation is:</p> $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$ <p>The diagram below shows what is in each test tube.</p> <p>1. Which litmus test results would you expect for each of the following?</p> <p>a hydrochloric acid b sodium hydroxide c sodium chloride solution</p> <table border="1"> <tbody> <tr> <td>A blue litmus-blue</td> <td>g red litmus-red</td> </tr> <tr> <td>C blue litmus-red</td> <td>D red litmus-blue</td> </tr> </tbody> </table> <p style="text-align: right;">1</p>	A blue litmus-blue	g red litmus-red	C blue litmus-red	D red litmus-blue	<p style="text-align: center;">Beaker contents</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Beaker contents</p> <p>Copper carbonate is gradually added to a beaker containing sulfuric acid. Copper sulfate solution is formed.</p> <p>1. Complete the table below to show what the beaker contains at each stage of the experiment.</p> <p>2. Describe how the pH changes during the reaction.</p> <table border="1"> <thead> <tr> <th>Substance</th> <th>Stage 1</th> <th>Stage 2</th> <th>Stage 3</th> </tr> </thead> <tbody> <tr> <td>sulfuric acid</td> <td></td> <td></td> <td></td> </tr> <tr> <td>copper carbonate</td> <td></td> <td></td> <td></td> </tr> <tr> <td>copper sulfate solution</td> <td></td> <td></td> <td></td> </tr> <tr> <td>water</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>	Substance	Stage 1	Stage 2	Stage 3	sulfuric acid				copper carbonate				copper sulfate solution				water				<p style="text-align: center;">Changing pH</p> <p style="text-align: center;">BEST STUDENT WORKSHEET</p> <p>Changing pH</p> <p>50cm³ of hydrochloric acid is added to a beaker. Sodium hydroxide solution is gradually added. Sodium chloride solution is formed.</p> <p>1. Complete the table below to show what the beaker contains at each stage of the experiment.</p> <p>2. Describe how the pH changes during the reaction.</p> <table border="1"> <thead> <tr> <th>Substance</th> <th>Start</th> <th>Midway</th> <th>End point</th> </tr> </thead> <tbody> <tr> <td>hydrochloric acid</td> <td></td> <td></td> <td></td> </tr> <tr> <td>sodium hydroxide solution</td> <td></td> <td></td> <td></td> </tr> <tr> <td>sodium chloride solution</td> <td></td> <td></td> <td></td> </tr> <tr> <td>water</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">1</p>	Substance	Start	Midway	End point	hydrochloric acid				sodium hydroxide solution				sodium chloride solution				water																																																														
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