

**Gifted Education School Network 2022/23**

**KLA/ Cluster: STEAM education**

**Lesson Design**

*Acknowledgements: This lesson example was adapted/adopted from the tryout by Mr CHAN Hon-kiu of G.T. (Ellen Yeung) College – Primary Section*

<b>School</b>	G.T. (Ellen Yeung) College – Primary Section
<b>Level</b>	Primary 6
<b>Topic</b>	Natural indicators
<b>Lesson Duration</b>	1 hour 10 minutes (double lesson)
<b>Learning Objectives</b>	<p>Knowledge</p> <ul style="list-style-type: none"> <li>- Define what a natural indicator is and identify examples of natural indicators.</li> <li>- Apply concept of natural indicators and the pH scale to real-world situations, such as testing the acidity of soil for gardening or the pH of water for drinking.</li> </ul> <p>Skills</p> <ul style="list-style-type: none"> <li>- Conduct experiments to test the pH of various substances using natural indicators.</li> <li>- Record and analyze data from experiments.</li> </ul> <p>Attitude</p> <ul style="list-style-type: none"> <li>- Develop a curiosity for the behavior of natural indicators</li> </ul>
<b>Prior knowledge of students</b>	<ul style="list-style-type: none"> <li>- Understanding of the pH scale and the concept of acidity and basicity.</li> <li>- Familiarity with the properties of acids and bases, such as their taste, and common household uses.</li> </ul>
<b>Highlights of this exemplar</b>	In this hands-on lesson, students will explore the behavior of natural indicators and learn how they can be used to test the pH of various substances. Using red cabbage and butterfly peas as examples of natural indicators, students will conduct experiments to observe color changes that occur when the indicator is exposed to acidic, basic or neutral substances. Through these experiments, students will develop a deeper understanding of the pH scale and the importance of natural indicators in everyday life. This lesson promotes higher-order thinking skills, such as analysis, synthesis, and evaluation, and encourages students to communicate their findings and conclusions with peers.
<b>Differentiation Strategies employed</b>	<ul style="list-style-type: none"> <li>● Flexible grouping</li> <li>● Higher-order questioning</li> </ul>

<b>Activities</b>	<b>Rationales for Implementation</b>
<p><b>Introduction - Indicators (5 mins) (Slide 1-3)</b></p> <p>The teacher plays a video about “What are Indicators” for students to learn about the science of indicators.</p>	<p>The video can help students better understand the science about indicators, and the teacher can further introduce the concept of end point.</p>

<p><b>Introduction - follow up (10 mins) (Slide 4-6)</b></p> <p>Students are required to work in groups to answer the questions about the content shown in the video, they need to write down their decided answers on mini-white boards.</p>	<p>The content of the video includes some advanced and enriched concepts of composition of universal indicator (e.g. why it is a mixture of indicators) which stimulate <b>creativity</b> among scientifically gifted/ more able students.</p>
<p><b>Task 1: Making red cabbage pH indicator (20 mins) (Slide 7-15)</b></p> <p>The teacher explains the apparatus, materials and procedures of making natural pH indicator using red cabbage, then teacher plays a demonstration video. Students work in groups to make red cabbage pH indicator.</p>	<p>The activity aims at developing students' experimental skills in using apparatus such as mortar and pestle to prepare natural pH indicators.</p> <p><b>Challenging questions</b> about different measures in obtaining a deeper colour of red cabbage pH indicator (increasing the concentration of anthocyanin in the solution) are designed to cater for the learning needs of scientifically gifted/ more able students.</p>
<p><b>Task 2: Testing pH of various substances using red cabbage pH indicator (10 mins) (Slide 16-18)</b></p> <p>The teacher shows various acidic and basic substances to students, i.e. citric acid, vinegar, baking soda and washing soda. Students test the pH of the substances with pH paper and red cabbage pH indicator respectively, then record the results of colour changes.</p>	<p>Students will learn the concept of strong acid/ base and weak acid/ base.</p> <p>The teacher invites students to share their results and the importance of testing with pH paper first.</p>
<p><b>Task 3a: Testing pH of various substances using butterfly pea pH indicator (5 mins) (Slide 19-20)</b></p> <p>Students prepare butterfly pea pH indicator by boiling water in groups. They test the pH of the substances with butterfly pea pH indicator, then record the results of colour changes.</p>	<p>Students experience the process of preparing natural pH indicator by using butterfly pea. They observe a different colour of butterfly pea tea.</p> <p>The teacher does not give the criteria of comparing different indicators in the beginning. Students discuss the criteria of a good indicator in groups. The process of result <b>analysis</b> and <b>evaluation</b> can offer an <b>advance</b> learning experience for the scientifically gifted/ more able students.</p>
<p><b>Task 3b: Compare red cabbage and butterfly pea pH indicators (10 mins) (Slide 21-23)</b></p> <p>Students compare the two different pH indicators in terms of obvious colour changes, pH ranges, ease of obtaining and preparation of materials. They discuss in groups and finish the activity worksheet, then present the reasonings in class.</p>	<p><i>Remarks:</i>  <i>The teacher can give hints to guide students with reference of the video about indicators and process of the experiment.</i></p>

**Conclusion (5 mins) (Slide 24-27)**

The teacher re-emphasizes the concept of pH and different indicators to find out the pH of various substances. The teacher poses a challenging question at the end: what if acid and base are mixed together?

The teacher can emphasize that different indicators have their own advantages and limitations.

Information of daily life applications of acid, base and neutralization (slide 28-35) will be put on eClass to offer after-class **enrichment** for the scientifically gifted/ more able students and arouse their **interests**.