Promoting the Use of Educational Technology in Learning and Teaching in Science (S1-3) Learning and Teaching Resources

Neutralisation

Part A: Background

- **Theme:** "Neutralisation"

- **Curriculum Link:** 9.3 Neutralisation
    - Understand that salt and water will be formed when an acid is mixed with alkali
    - Recognise that the mass of reactants and products is conserved in neutralisation reaction
    - Present the change in pH in a neutralisation reaction with a pH curve

- **Prior Knowledge**
    - State the properties of acids and alkalis
    - Recognise the acid-alkali indicators are used to classify solutions as being acidic or alkaline
    - Recognise that the pH scale is used to describe the relative acidity and alkalinity of substance

- **Scaffolding Learning Materials**
    - Search information on the uses of some common acidic and alkaline substances
    - Use acid-alkali indicators or natural indicators to classify solutions as being acidic or alkaline
    - Use pH paper, universal indicator, pH meter with data logger system to find the pH values
        - <u>Subsequent Learning Activity:</u>
            - Search information on some applications of neutralisation in daily life (i.e. household cleaning, food & beverage)
            - Observing, analyzing and presenting data in graphical presentation from pH scale

- **Scientific Model Used:** Bronsted-Lowry acid-base theory

Part B: Lesson Planning

- Rationale
    - The Use of Edtech Tool
        - In this lesson, students are required to create visual representations instead of learning from those teachers' presentations. Student-generated diagrams can reveal what students know about given concepts, as the diagrams function as external representations of their ideas.
        - The DragGame provides an easy and effective way for teachers to assess students' learning of such a multi-staged neutralisation reaction.
        - This lesson includes 3 parts, **(i) pre, (ii)intervention and (iii) post** involve the use of a technological platform, DragGame to strengthen students' observation and communication skill related to neutralisation.

        - Specifically, performing practical work to show that water and salt are formed in the neutralisation reaction between **dilute hydrochloric acid and dilute sodium hydroxide solution**, students are shown a model of acids and alkalis mixing. As a result, students understand that it is necessary to mix acids and alkalis together to work as a neutralisation reaction.

    - Technological Pedagogical Arrangement
        - Technological pedagogical content knowledge (TPACK) applies in this unit of learning. Teacher uses a DragGame platform to list out the reaction of acids and alkalis mixing together.
        - The pH values change during the experiment's progress.
        - Teacher refers to the result of the pre-test for reviewing students' performance and finding out the knowledge and skills that require teachers' intervention.
        - During the lesson, teacher applies DragGame activity to check student's misconceptions and their understanding of different learning objectives, including features of acids and alkalis and the nature of neutralisation.
        - After the lesson, teacher uses a post-test and worksheet to review students' understanding of the learning content and gather feedback for future formative assessments.
        - Students can revisit the DragGame activity after the lesson to consolidate their learning.

- Learning Objectives
    - Knowledge
        - Understand that salt and water will be formed when an acid is mixed with alkali, and heat will also be released during the process
        - Give examples of applications of neutralisation
        - Recognise that the mass of reactants and products is conserved in neutralisation reaction

    - Skills
        - Present the change in pH in a neutralisation reaction with a pH Curve

    - Attitude and Values
        - Perseverance: Demonstrate courage in face of challenging the learning tasks
        - Respect for others: Maintain friendly and peaceful relationships with peers that hold different views in discussions.
        - Be grateful: Appreciate the applications of science makes our daily lives more convenient

- Lesson Time
    - 60 minutes

- Learning and Teaching Materials
    - Pre-test (Appendix 1)

- Post-test (Appendix 2)
- DragGame Activity: https://draggame.e-learning.hk/en/templates/403/view/

Part C: Lesson Arrangement

- **Lead-in**
  - **Guiding Questions**
    - When the start of experiment 9.6 "studying the change of pH value during neutralisation", what colour can be observed from the starting solution?
    - Once the experiment starts, when does the mixture change colour?
    - What is the expected colour of the mixture when excess alkali is added?
    - Which tool of measurement is more precise? pH meter or universal indicator? Why?
    - What are the products of the neutralisation after the experiment?

- **Development**
  - **Learning Content**
    - Teacher reviews the concept of acids and bases, list out their properties including implementation of the concept of pH scale
    - Elaborating the definition of neutralisation and the chemical reaction involving, including the rationale of writing chemical equations.
    - Conducting simple experiments to observe the changes that happen during neutralisation reactions, for example the reaction of an acid with alkali
    - Teacher holds the experiment for the neutralisation, plot the pH value of solution against the volume of alkali added → practical activities
    - DragGame link: https://draggame.e-learning.hk/en/templates/293/view/
    - The teacher demonstrates the DragGame activity, which provides ideas to students for the nature of DragGame.
    - Presentation slides

  - **Probing Questions**
    - Further to the DragGame activity, how many particles are listed under acids, neutral and alkaline?
    - Does the particle arrangement work as a single type of particle or mixed with particles?
    - From the DragGame diagram, how is the distance between each particle? Very packed? Very few? Or anything else?
    - The number of particles follows from pH values? Or anything else?
    - If strong acid and strong alkalis combine together, how's the product output?
    - If weak acid and weak alkalis combine together, how's the product output?
    - Is it possible to combine acid particle, alkali particle and water particle in acidic solution, neutral solution and alkaline solution?
    - Why is neutralisation an important concept in chemistry?
    - How does neutralisation apply in our daily life?

- **Application of neutralisation**
    - Teacher provides an idea of word equation for neutralisation, which also give rise to the ideas of application in daily life example:
    - Why do we need to brush our teeth?
    - How can we relieve stomach pain?

    - **The Drag Game Activity**
        - https://draggame.e-learning.hk/en/templates/403/view/ (This DragGame Activity is helping students to understand reaction from adding acidic solutions into alkaline solutions)

- Strategy for probing students' understanding
    - Pre-test: Testing prior knowledge from students and making sure they are familiar with the nature of acids and alkalis.
    - DragGame activity and Lesson instructions: The teacher applies experiments from acids to alkalis, students observe colour changing from indicators. They know about the nature of naturalisation.
    - Post-test: For the post-test, it can consolidate students' learning outcome from neutralisation and their products.

Appendix 1: Pre-Test Questions:
*** 1 mark each, 10 marks in total**

Pre-Test Questions
Integrated Science (S2)
Neutralisation

Name :		Class :	( )	Date :	

1. What is neutralisation?
   a) The process of combining an acid and a base to form salt and water.
   b) The process of combining two acids to form a base.
   c) The process of combining a base and a metal to form a salt.
   d) The process of combining two bases to form an acid.
   Answer: a) The process of combining an acid and a base to form salt and water.

2. Which of the following is a product of a neutralisation reaction?
   a) Hydrogen gas (H_2)
   b) Carbon dioxide gas (CO_2)
   c) Oxygen gas (O_2)
   d) Water (H_2O)
   Answer: d) Water (H_2O)

3. Which of the following substances is commonly used as a base in neutralisation reactions?
   a) Vinegar (acetic acid)
   b) Lemon juice (citric acid)
   c) Sodium hydroxide (NaOH)
   d) Hydrochloric acid (HCl)
   Answer: c) Sodium hydroxide (NaOH)

4. What is the pH value of a neutral solution?
   a) 0
   b) 7
   c) 14
   d) 1
   Answer: b) 7

5. Which indicator is not used to determine the endpoint of a neutralisation reaction?

a) Hydrogencarbonate indicator
b) Phenolphthalein
c) Bromothymol blue
d) Methyl orange
Answer: a) Hydrogencarbonate indicator

6. Neutralisation is regarded as a physical change.
(Answer: False, neutralisation is a chemical reaction between acids and alkalis)

7. When an **(a)** and a **(b)** react, they **(c)** each other, forming a salt and water. This process is called **(d)**.
(Definition of neutralisation)

a)	b)
c)	d)

Answer: a) acid; b) base/alkali c) neutralise d) neutralisation

Appendix 2: Post-Test Questions
*** 1 mark each, in total 10 marks**

Post-Test Questions
Integrated Science (S2)
Neutralisation

Name :		Class :	( )	Date :	

1. Neutralisation is the process of combining an acid and a base to form ____ and water.
Answer: salt

2. The pH value of a neutral solution is ____.
Answer: 7

3. A substance that is commonly used as a base in neutralisation reactions is _____ _____.
Answer: sodium hydroxide (NaOH)

4. Which of the following statement about neutralisation is not correct?
a) Neutralisation is an exothermic reaction.
b) Neutralisation will produce water.
c) Acid can neutralise alkali, but alkali cannot neutralise acid.
d) Neutralisation will produce salt.

Answer: c) Acid can neutralise alkali, but alkali cannot neutralize acid.

5. Which of the following will undergo neutralisation after mixing with a pH 3 solution?
a) pH 1 solution
b) pH 5 solution
c) pH 7 solution
d) pH 9 solution

Answer: d) pH 9 solution

6. Which of the following is not an example of neutralisation?
a) Using toothpaste to brush the teeth
b) Using antacid to relieve stomachache
c) Adding sugar to salty food
d) Treating of insect stings with vinegar

Answer:
c) Adding sugar to salty food

7. Which of the following is the correct description of neutralisation between acid and alkali?

a. acid + alkali → salt + water
b. acid + alkali → acid + alkali + hydrogen
c. acid + alkali → salt + acid + alkali
d. acid + alkali → salt + oxygen

Answer: a) acid + alkali → salt + water

8. Classify the nature of substance and stat the pH value (in integer) of the following items (with correct acidity/alkalinity and pH value = 1 mark).

Item	**Nature of substances**	**Approx. pH Value**
 Pure Water	Answer: Neutral	Answer: pH 7
 Soap	Answer: Alkaline	Answer: pH 9
 Gastric Juice	Answer: Acidic	Answer: pH 2