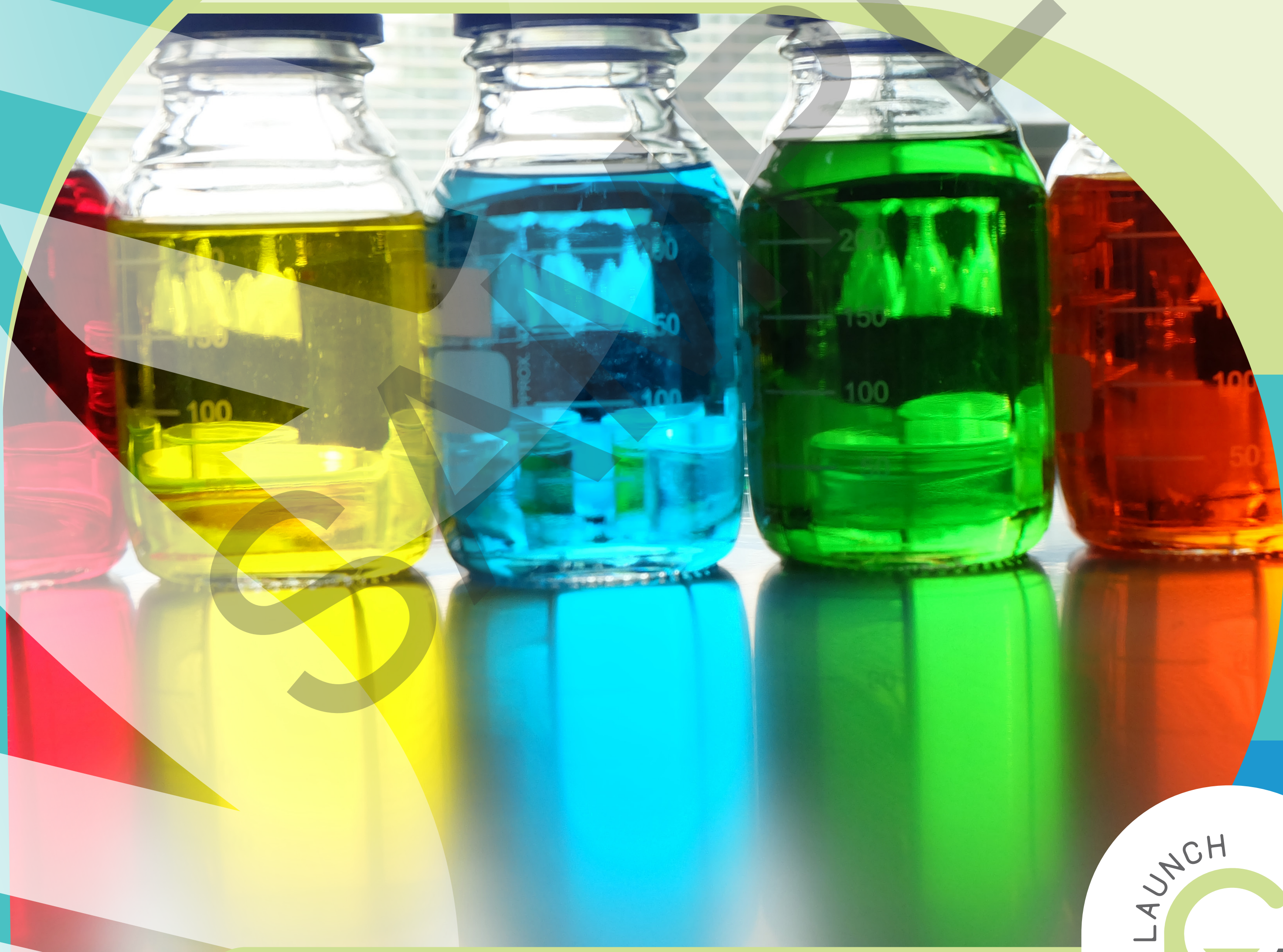
REACTION RAINBOW



TEACHER GUIDE

LAUNCH

PLANNING

Here's a suggested schedule for this kit! The activities are designed to be completed in order, but you can decide when to do them over time. Required times are estimated.

ACTIVITY INFORMATION	SECTION (S)	TIME REQUIRED	DAY/ LESSON
ACTIVITY 1: RESIN AND REASONS Find out about the fascinating foam that forms on certain trees. **Time required: 2 h**	☐ Tree Bubbles	30 minutes	Day 1
	☐ Make Your Own Tree Bubbles	90 minutes	Day 2
ACTIVITY 2: REACTIONS AND SOLUTIONS Investigate how solutions work and learn about different reactions. **Time required: 3 h**	☐ Types of Reactions	90 minutes	Day 3
	☐ Aqueous Action	90 minutes	Day 4
ACTIVITY 3: ACIDS AND BASES Ponder the properties of acids and bases and how pH is used to describe them. **Time required: 3 h**	☐ Incredible Ions	90 minutes	Day 5

activity

3 ACIDS AND BASES

Water allows reactions to happen. Encourage your student to think about which properties of water (at the particle level) allow ions to interact.

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LEARNING GOALS:

✓ I can use models to show how acids and bases behave at a particle level and affect the pH of a solution.

INCREDIBLE IONS

Not Just H_2O

• Your student will study the particle basis of properties of acids and bases in solution.

• The following vocabulary terms are defined: acid-base equilibrium, conjugate acid, conjugate base, and amphoteric.

• The details are limited regarding acid-base equilibrium in the Student Workbook. If your student wants more detail, you can share this with them:

- pKa = −log(Ka) where Ka is the acid dissociation constant
- The acid dissociation constant Ka is calculated as follows:

$$Ka = \frac{[H+][\{A-\}}{[HA]}$$

- This mirrors the equation for Ka of a reaction with the equation

A + B → C + D:

$$Ka = \frac{[C]^C[D]^D}{[A]^A[B]^B}$$

where each of the letters in brackets represents the concentration of that compound.

MULTIPLE AGES AND ABILITIES:

Depending on your student's interest and level of understanding, you could introduce additional definitions of acids and bases. We have used the most widely used definition (Arrhenius), but they could also study the following definitions:

- **Bronsted-Lowry**
  - **An acid is a reactant that donates a proton in a reaction.**
  - **A base is a reactant that accepts a proton in a reaction.**
- **Lewis**
  - **An acid is a species that accepts electron pairs in a covalent bond.**
  - **A base is a species that donates electron pairs in a covalent bond.**

THINK ABOUT IT!

Question 1: The self-ionization of water was proposed when it was discovered that pure water has a small amount of electrical conductivity. Why do you think self-ionization makes water slightly conductive?

Answer: Electricity requires ions to travel through a liquid. and the hydronium and hydroxide ions act as electrolytes.

Question 2: How do you think equilibrium changes before and after an acid-base reaction?

Answer: The equilibrium favors the products until they are equal in concentration, and then they go back and forth slightly.

MULTIPLE AGES AND ABILITIES:

For students with an interest in simulations, modeling, or computers, you can have them build a titration curve using spreadsheet software. Have them study the shape of a titration curve before and after the equivalence point, noting the logarithmic shape. Then, have them experiment to collect data, build a data set, and create a graph that a titration curve based on their experimental data. This can also be done with multiple students working on their own curve or working together to collect data and make a curve for the group.

THINK ABOUT IT!

Question: Summarize the titration process using your own words (you can also use drawings if you want).

Answer:

- Answers will vary, but here is an example:
  - A titration involves adding a solution with a known concentration to a solution with an unknown concentration. This happens until a visible change happens, which is the equivalence point. The amount of known solution added lets the experimenter know what the concentration of the unknown solution was.

How to Help: *Review the titration setup diagram and explanation as needed.*

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TRY A TITRATION

PREPARATION AND SUPERVISION:

- In this hands-on activity, your student will use a drop-count titration to neutralize a solution of vinegar with sodium hydroxide and determine if the listed concentration of vinegar is accurate.
- Your student will need to pay close attention to the color of the indicator, having a firm idea of what the color will be for the equivalence point (it should be green to show neutralization).
- The number of drops may vary based on conditions and human variability; in our tests, it was about 40–50 drops.
- You can have your student complete the procedure with more dilute vinegar to make the titration faster.

THINK ABOUT IT!

Question 1: How does the expected amount of NaOH needed compare to how much you used? Calculate your percent error using this equation:

$$\textbf{Percent (\%) error} = \frac{\textbf{actual result - expected result}}{\textbf{expected result}} \times 100$$

Answer: Answers will vary.

How to Help: *Discuss potential sources of error, such as the initial measuring using the pipet, the dilution process, and the possible variability in drop size.*

LAUNCH
SCIENCE UNLOCKED

Contact us at: www.homesciencetools.com/customer-service/

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Kit	SU-RERAIN
Instructions	SU-RERAINS
Revision Date	7/2022