UC RIVERSIDE | College of Natural & Agricultural Sciences

UC RIVERSIDE | Department of Chemistry

Elephant Toothpaste (45 min)

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Course Name	*Elephant Toothpaste Experiment*	**Day/Date**	
Objective(s)	• **Study chemical changes how hydrogen peroxide changes into oxygen and water vapors.** • **Have students consider what variables they want to change.** • **Design and conduct a scientific investigation**		
Materials	A. **<u>Experiment Design</u>** - Worksheet - Pencil B. **<u>Making Elephant Toothpaste</u>** - Hydrogen Peroxide (2%) - Large Tub - Yeast - Stirring Stick - Paper Towels - Food Coloring - Dish Detergent - Gloves We will supply all necessary materials.	**Key Points**	**Chemical Change –** chemical reaction occurs when atoms are broken and formed. **Physical Change –** any change that does not change its chemical make-up. **Independent Variable –** a variable whose variation does not depend on another variable **Dependent Variable –** a variable whose variation is dependent on another variable **Catalyst** – a substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical changes. *<u>Other key words:</u>* *Hypothesis* *Observation* *Variable* *Decompose*
Big Questions	What chemical changes does the hydrogen peroxide have? Why does the whole mixture turn into the toothpaste? What factors can I change and how will that affect the experiment?		

Do First (10 min)	**1) Personal introduction:** We are students and researchers from UC Riverside (can calculate "grade level" for the students) studying chemistry! **2) Topic introduction:** a) Write the 6 key words on the board b) Introduce **"catalyst, decompose, chemical, and physical change"** and poll the class to see if anyone has heard of the word "**independent and dependent variable**" before or knows any examples of independent and dependent variables. c) Discuss real life examples of catalyst(yeast), chemical changes (cooking, rusting, and rotting), and physical changes(boiling, freezing, and melting)

	d) Display commercial silly putty and explain what constitutes its unique properties. Explain making and breaking of bonds as a driving force to its tendency to shatter or stretch. e) Explain what the catalyst (yeast) is, what is being decompose (hydrogen peroxide), and the item undergoing physical change (detergent).
Lesson Execution (40 min)	**Learning Experiences:** ***In Break-Out Room*** **A) Experiment Design (5-10 min.)** Concepts: Hypothesis, Observation, Variable Instructions: (Have students work in small groups) 1. Outline the elephant toothpaste experiment. 2. Collectively form a hypothesis, based on above introduction, to what might happen when we change different independent variables. 3. Create, in advance, a systematic method for recording results (methods) a. Amount toothpaste made b. Change in composition c. Brainstorm with class three other observations 4. Discuss appropriate variables to test our hypothesis a. Adding food coloring b. Adding more yeast c. Adding more hydrogen peroxide d. Adding more soap e. Changing the catalyst ***As a Group*** **B) Students formulate their own hypothesis (30-35 mins)** Concepts: control experiment, variable Instructions: (Students will observe the graduate student conduct the experiment and students can safely formulate what factors they want to change) Each Students will formulate: 1. Students will formulate their own independent hypothesis to the conditions they want to change on the worksheet. 2. Define what the independent variable they are changing and what dependent variable changes are affected. 3. Each Student will provide their predictions and their reasoning for why they think this will happen. Graduate student will be prepared to dispute or agree with students' hypothesis: 1. Adding more soap will 2. Adding different food color will 3. Adding more yeast will 4. Adding more hydrogen peroxide will 5. Using less hydrogen peroxide will 6. Using less soap will 7. Using less yeast will Each Student will have to: 1. Vote on the variable we will change, and the graduate students will prepare the conditions.

	2. Each variable change with the most votes will be demonstrated, and students will consider if their hypothesis was correct and if not, graduate students will explain what happened. 3. Discussion will be done to discuss that having a correct or incorrect hypothesis is not important, but learning what different changes occurred with the independent and dependent variables.
Wrap-up: Sharing Experiences and Building Connections (10 min)	We will bring everyone back as one group and review the key concepts. Each group's ambassador(s) can lead a part of the discussion, presenting the results of varying each component in the elephant toothpaste process. Ask each ambassador what they think a good second experiment would be to further support their results/hypothesis. Encourage students to think about the many different physical and chemical changes they encounter every day and how their molecular structures or physical structure is changed. Ask students if they have any last questions about the experiments or about being a scientist in general.

AMAZING TOOTHPASTE PLANNING SHEET

My testable question is:

What is the effect of _____ on

_____.

My hypothesis is:

If _____, then

_____.

MATERIALS

What one thing will I change on purpose? Scientists call this the **independent variable**.

_____

_____

How will I know if the one thing I changed on purpose made any difference? (How I will measure, observe, and collect data in the experiment). Scientists call this the **dependent** variable.

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What things will I need to keep the same in order to conduct a fair test? (Constants)

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