

# The Next Generation Science Standards (NGSS)

## CHAPTER 6, LESSON 5: A CATALYST AND THE RATE OF REACTION

**MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.**

**MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.**

### DISCIPLINARY CORE IDEAS

- PS1.A: Structure and Properties of Matter
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-5)
- The total number of each type of atom is conserved and thus the mass does not change. (MS-PS1-5)
- Some chemical reactions release energy; others store energy (MS-PS1-6)

*Students learn that hydrogen peroxide molecules react with each other to produce water and oxygen gas. They see that the total number of each type of atom in the reactants is also in the products. Students also see that yeast catalyzes the reaction and that the reaction releases energy.*

### SCIENCE AND ENGINEERING PRACTICES

#### *Developing and Using Models*

- Develop a model to describe unobservable mechanisms. (MS-PS3-2)

#### *Planning and carrying out investigations*

#### *Engaging in argument from evidence*

*Students investigate the question: Can yeast catalyze the decomposition of hydrogen peroxide? Students plan and conduct an investigation to see if the catalyst in yeast affects the rate at which hydrogen peroxide molecules react with each other to form oxygen gas. Students use the amount of oxygen produced as a measure of the rate of the reaction and see that adding a catalyst does increase the rate of the reaction. Students see a molecular model illustration of the reaction showing that oxygen gas is produced.*

*Students use and further develop this molecular model and apply it to evidence they have observed to explain their observations on the molecular level and to answer the question to investigate.*

## **CROSCUTTING CONCEPTS**

### *Cause and Effect*

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

### *Scale, Proportion, and Quantity*

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

### *Energy and Matter*

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

*Students use a molecular model of a reaction between hydrogen peroxide molecules, and an explanation of how catalysts work, to explain how adding a catalyst affects the macroscopic observation of the increased rate of reaction.*