



Science Objectives

- Students will observe the properties of chemical reactions between various solid and aqueous substances.
- Students will analyze and balance chemical equations that describe chemical reactions observed in the simulation.

Vocabulary

- chemical reaction
- chemical change
- chemical formula
- chemical equation
- phase
- physical change
- physical reaction
- precipitate
- product
- reactant

About the Lesson

- In this lesson, students will:
 - Observe and identify factors associated with chemical reactions.
 - Recognize the reactants and products of various chemical reactions.
 - Balance chemical equations.

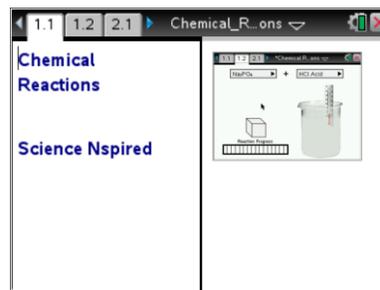


TI-Nspire™ Navigator™

- Send out the *Chemical_Reactions.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Chemical_Reactions_Student.doc
- Chemical_Reactions_Student.pdf

TI-Nspire document

- Chemical_Reactions.tns

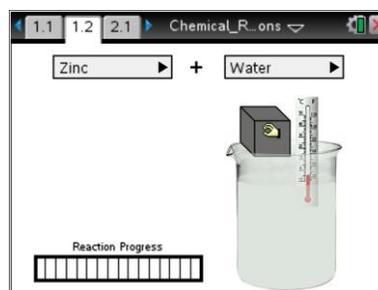
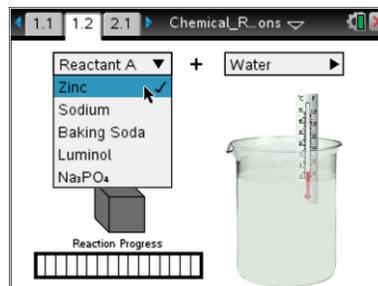


Discussion Points and Possible Answers

Have students read the background information for this simulation on their student activity sheets.

Move to page 1.2

1. In this simulation students will explore the chemical reaction between a number of solid and liquid substances. To begin, have students select “Zinc” from the first drop-down menu. They should also select “Water” from the second menu. Then, have students drag the solid cube of zinc into the beaker of water and release it. Have students observe the reaction that takes place and record the results in the table on their student activity sheets.
2. Have students repeat step 1 for each combination of solid and liquid substances. Be sure that they record any observations from the reaction in the table.



Tech Tip: To access the Directions again, select **menu** or **Document Tools** () > **Chemical Reactions** > **Directions**.



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Solid	Liquid	Chemical Reaction? (Yes/No)	Observations
zinc	water	no	no reaction occurs
zinc	HCl acid	yes	temperature increase; gas bubbles released
zinc	30% H ₂ O ₂	no	gas bubbles released
zinc	Ca(NO ₃) ₂	no	no reaction occurs
zinc	CuSO ₄	yes	color changed from blue to clear
sodium	water	yes	rapid temperature increase; container breaks
sodium	HCl acid	yes	rapid temperature increase; container breaks
sodium	30% H ₂ O ₂	yes	rapid temperature increase; container breaks
sodium	Ca(NO ₃) ₂	yes	rapid temperature increase; container breaks
sodium	CuSO ₄	yes	rapid temperature increase; container breaks
baking soda	water	yes	no reaction occurs
baking soda	HCl acid	yes	gas produced; temperature increase
baking soda	30% H ₂ O ₂	yes	no reaction occurs
baking soda	Ca(NO ₃) ₂	yes	gas produced
baking soda	CuSO ₄	yes	color changes to light blue
Luminol	water	no	no reaction occurs
Luminol	HCl acid	no	no reaction occurs
Luminol	30% H ₂ O ₂	yes	light is emitted from the container
Luminol	Ca(NO ₃) ₂	no	no reaction occurs
Luminol	CuSO ₄	no	no reaction occurs
Na ₃ PO ₄	water	no	no reaction occurs
Na ₃ PO ₄	HCl acid	no	no reaction occurs
Na ₃ PO ₄	30% H ₂ O ₂	no	no reaction occurs
Na ₃ PO ₄	Ca(NO ₃) ₂	yes	formation of a precipitate
Na ₃ PO ₄	CuSO ₄	no	no reaction occurs



Move to Pages 2.1 - 2.3.

Have students answer question 1 - 3 in the .tns file, the activity sheet, or both.

Q1. Give one example of a physical change.

Sample Answer: Student answers will vary; Some examples of physical changes are: boiling water, freezing ice, dyeing an object a different color, breaking or crushing an object

Q2. Give one example of a chemical change.

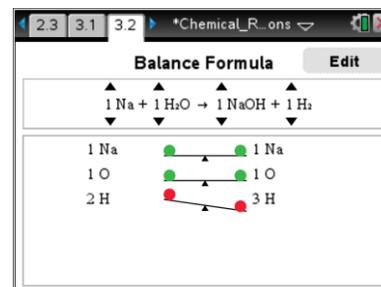
Sample Answer: Student answers will vary; Some examples of chemical changes are: burning wood, baking bread, rusting iron, saliva breaking down food when we eat, using batteries

Q3. List four different indicators of a chemical change that occurred in the simulation.

Sample Answer: gas production, temperature increase, color change, formation of a precipitate

Move to Pages 3.1 - 3.2.

5. Next, students will analyze and balance the chemical equations of a few of the chemical reactions that they have explored in the simulation. The equations are given on Pages 3.2-3.8. To enter the reactants of the equation, have students select the dotted box to the left of the arrow. Then, have students enter the chemical formula for each reactant into the box. (Subscripts will be formatted automatically.) To enter the products of the equation, students should select the box to the right of the arrow and repeat the process.



6. Then, have students select the "Balance" button. They should select the up and down arrows to modify the amounts of each reactant and product in the reaction. Tell students that the goal is to make sure that there are equal amounts of each element on both sides of the equation.

Move to Pages 3.3 - 3.6.

Have students answer questions 4 - 7 in the .tns file, the activity sheet, or both.

Q4. The reaction between zinc and HCl is given by the symbolic equation $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$. Note that H_2 is hydrogen gas. Did you observe any evidence of H_2 forming in the reaction? Explain.



Sample Answer: Yes, gas bubbles were produced during the reaction.

Q5. Balance the equation from question 4: _____ Zn + _____ HCl → _____ ZnCl₂ + _____ H₂

Answer: Zn + 2HCl → ZnCl₂ + H₂

Q6. The reaction between sodium and water can be explosive. Based on your observations, give one reason why the container may have exploded.

Sample Answer: The temperature of the mixture increased a large amount in a short period of time. This could have caused the container to explode.

Q7. The reaction between sodium and water is given by: _____ Na + _____ H₂O → _____ NaOH + _____ H₂. Balance this equation.

Answer: 2Na + 2H₂O → 2NaOH + H₂



TI-Nspire Navigator Opportunities

Make a student a Live Presenter to illustrate how to test one variable at a time during the simulation investigation. Throughout the activity, monitor student progress. At the end of the activity, collect the .tns file and save to Portfolio.

Wrap Up

Students should compose a lab report, which includes their data, analysis, and a discussion of the results of their test. Students may choose to use the TI-Nspire™ Student Edition software to convert their .tns files to PublishView Documents.

Extensions

Students can observe simple endothermic reactions (citric acid and baking soda) and exothermic reactions (vinegar and baking soda). They can measure temperature changes using the EZ-Temp tool to collect and analyze temperatures before and after the reactions.

Assessment

- Use the questions in the Nspire document as Quick Polls during the lesson as needed.
- The questions in the Nspire document can be Self-Check, so students can check their answers.