Lesson 2.3: Chemical Properties and Changes

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Task 1 Learning Target: I can describe chemical properties and changes of matter.

Video Links:

https://www.brainpop.com/science/matterandchemistry/propertychanges/

https://www.youtube.com/watch?v=5iowJs6MryI

https://www.youtube.com/watch?v=Z5L2NOMEWT0

https://www.youtube.com/watch?v=x49BtB5dOwg

https://www.youtube.com/watch?v=BOr76Zx48QM

1. Chemical

A. **Chemical properties**: _____

a. Examples: _____

B. **Chemical changes**: change in identity due to chemical properties ------not reversible

a. Examples: _____

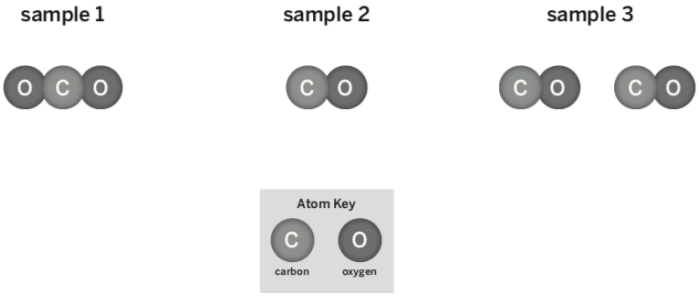
Task 2 Learning Target: I can use a digital simulation to investigate substance properties and atomic models in order to determine that different substances are made up of different types and numbers of atoms arranged in different ways.

Atoms are too small to see. Scientists rely on models to study things that are too small (or too large) to see. The Chemical Reactions Simulation can help us learn more about the atoms that make up various substances. The Simulation is a scientific model. Although this model is different from real life, it is accurate in many ways. We know that different substances have different properties. To learn more about why this is the case, we are going to use the Chemical Reactions Sim to investigate different samples at two scales: the macroscale that is visible to us, and the much smaller atomic scale. This will help us learn more about atoms and what they tell us about substances and their properties.

1. Explore the Chemical Reactions Sim: https://apps.learning.amplify.com/chemicalreactions/
   - test one or two substances at the same time.
   - turn on the View Atomic Scale toggle to see the substances at the atomic scale.
   - turn on View Properties toggle to view some of the properties of substances.

   Use the following sentence starters to describe your thoughts:
   - *I notice/observe . . .*
   - *I think this is important because . . .*
   - *I wonder . . .*

2. With your partner, compare the atomic-scale models of the three samples shown below. Draw and describe how these models are similar and how they are different.



3. Based on the atomic-scale models of the samples, record one of the following claims you think is best:
   Claim 1: *All three samples have the same properties. Therefore, they are the same substance.*
   Claim 2: *Two samples have the same properties. Therefore, they are the same substance. However, one sample has a different set of properties. Therefore, this sample is a different substance.*
   Claim 3: *All three samples have different properties. Therefore, they are different substances.*

4. Find the substances represented by these models in the Chemical Stockroom mode of the Sim.
   a. Observe and record their properties.
   b. Does the evidence from the Sim support the claim that you chose?
   c. What evidence did you find in the Sim to support your answer?

5. Complete the following prompts: *Based on my observations in the Sim, I think:*
   d. *sample 1 and sample 2 are*
   -the same substance with the same properties. *-different substances with different properties.*

   e. *sample 1 and sample 3 are*
   -the same substance with the same properties. *-different substances with different properties.*

   f. *sample 2 and sample 3 are*
   -the same substance with the same properties. *-different substances with different properties.*

Task 3 Learning Target: I can collect data from an investigation and digital simulation in order to explain if substances can change into different substances.

Chemical Reactions Sorting Tool: Use this tool to help you evaluate evidence. Place evidence on the Evidence Gradient based on how strong you think the evidence is according to the Evidence Criterion: More detailed observations provide stronger evidence. https://apps.learning.amplify.com/sortingtool/#/tool/166/level/13_Evaluating_Evidence_id_2583

Initial Observations
1. Do not mix any liquids yet. Never taste or smell anything.
2. Record the properties of each substance in the data table ("Before combining" section).
Reminder: Properties are things such as color, texture, and phase at room temperature.

Combining Substances
3. Slowly pour the entire contents of each cup into the cup labeled "product."
4. Do not stir the product. It's important that you not move the cup.
5. Observe what happens in the product cup for at least one minute.
6. Record the properties of the substance or substances inside the product cup in the data table ("After combining" section).

Table 1: _____

Before combining		After combining
Substance 1 dissolved in water calcium chloride ($CaCl_2$):	Substance 2 dissolved in water sodium carbonate (Na_2CO_3):	Product:
Mass:	Mass:	Mass:

A. What happened when you combined the two substances together in the cup?
The substances changed into different substances.
The substances did not change into different substances.
I am not sure if the substances changed into different substances.

Mixing Substances in the Sim

1. Launch the *Chemical Reactions* Sim: https://apps.learning.amplify.com/chemicalreactions/
2. In Laboratory A mode, press the Add Substance button and choose calcium chloride ($CaCl_2$).
3. Press the Add Substance button and choose sodium carbonate (Na_2CO_3).
4. Press TEST and observe what happens.
5. Press RESULTS and examine the results.
6. Press REVIEW and compare the substances at the Test Start and Test End.

B. Draw the "Test Start" and "Test End" atomic model.

7. Turn on View Atomic Scale and View Properties toggles.

C. How do the properties of the different substances compare?

8. Use evidence from the final review screen to help you answer the questions below.

D. What happened when you combined the two substances together in the cup?
Explain your answer using evidence from the Sim.

The substances changed into different substances.
The substances did not change into different substances.
I am not sure if the substances changed into different substances.

E. Based on the evidence you collected in the hands-on activity and the Sim,
answer the Investigation Question: *Can substances change into different substances?*

-What evidence did you gather from the hands-on investigation that supports your claim?
-What evidence did you gather from the Sim investigation that supports your claim?

F. The law of conservation of matter states that although matter can change form, it cannot be created or destroyed. In other words, the number of atoms in the reactants (the "ingredients" or substances before a chemical reaction) will equal the atoms in the products (the things that are given off after the "ingredients" undergo a chemical reaction).
How can we prove the law of conservation of matter for our hands-on experiment and Sim model?
What would you expect to happen?

G. Compare the combined mass of the 2 liquids before and after the chemical reaction.
The sum of the mass of the 2 liquids before mixing was _____.
The mass of the 2 liquids after mixing them was _____.

H. Compare the number of each type of atom at the "Test Start" to the number of each type of atom at the "Test End."
Did you use any more or any less of an atom?
Are your reactants and products the same?
Describe how the arrangements of atoms have changed.

Task 4 Learning Target: I can use text evidence to describe how and why synthetic substances are made.

For billions of years, every substance on Earth was produced in nature, through natural processes, and without input from people. However, within the last few centuries, people have begun experimenting with making substances we can't find in nature. Substances that are produced by humans instead of being found in nature are called synthetic. Scientists make synthetic substances by arranging atoms and molecules in the lab. They use what they know about different types of atoms and molecules to arrange them and make the kinds of substances they want. One type of synthetic material that you probably use every day is plastic. Scientists developed plastics in the early 1900s. Plastic is made from petroleum, a natural resource that is also used to make gasoline and other products. By combining different atoms and molecules, scientists are able to make lots of different kinds of plastic for lots of different purposes, from bottles to boats. Plastic is very useful, but also causes problems. For example, a large amount of plastic ends up in the ocean and harms ocean animals.

In some cases, synthetic substances are copies of substances found in nature. If the synthetic substances are copies of natural substances, scientists can analyze the natural substances and arrange the same types of atoms in the same way. For example, many plants found in the rain forests of Asia, Africa, and South America have properties that can be used for healing all kinds of health problems, from small cuts to serious diseases. These plants have been used for healing by people who live in and near the rain forests for thousands of years, and in recent years, scientists have begun to understand the substances inside them that make them good for healing. In some cases, scientists have been able to make synthetic versions of those substances, producing them in large amounts without needing to travel to the rain forests.

Synthetic medicines aren't any different at the atomic level from the natural medicines found in the rain forest. After all, molecules are just molecules—whether they're made in nature or in a lab, the same types of atoms arranged in the same ways always form the same molecules that behave in the same ways.

The rain forest is a rich source of medicines for humans to use, but it may not be for much longer. Earth's rain forests are being burned and cut down to make room for farms and other uses. In fact, about 325 square kilometers (125 square miles) are cut down every day. At this rate, our rain forests may be gone soon.

a. How are synthetic substances made?
b. At the atomic level, are synthetic medicines different from natural medicines? Explain your answer.
c. Why is it useful to be able to produce synthetic medicines?

Task 5 Learning Target: I can use a digital simulation to find two substances that react when mixed together and two substances that do not react when mixed together.

1. Launch the Sim and open Laboratory A mode: https://apps.learning.amplify.com/chemicalreactions/

2. Press the Add Substance button and select two substances of your choice.

3. Press TEST, then press RESULTS, then press REVIEW.

4. With your partner, discuss whether or not a chemical reaction occurred.

5. Carefully re-watch the atomic-scale animation.

   A.

If a chemical reaction occurred, answer: When a chemical reaction occurs, what happens to the atoms of the two substances?	If a chemical reaction did not occur, answer: When a chemical reaction does not occur, what happens to the atoms of the two substances?

6. Repeat the above steps with different substances until you have found two substances that react and two that do not react.

7. When you have finished your tests, answer:

B. Did any of the atoms ever change type?

Task 6 Learning Target: I can use physical and chemical properties of matter in order to identify an unknown powder.

A millionaire noticed her beloved antique pearl necklace was missing from her jewelry box. CSI (Crime Scene Investigation) was called out to find clues that might prove who stole the necklace.
Evidence: After searching the scene of the crime, investigators found some mysterious white powder on the jewelry box. Through further investigation, new evidence was uncovered and four suspects were determined, all of which were the millionaire's personal employees. Each employee is known to be unhappy in their work conditions and frequently uses a specific white powder.

The Farmer
Farmer Bob raises corn to create cornstarch for the millionaire. The cornstarch is used for cooking by the chef and the remainder is sold to make money that the millionaire always spends on herself. Farmer Bob is sick of the millionaire's selfish ways. Could the cornstarch Farmer Bob makes be the powder found on the jewelry box?

The Personal Chef
Chef Joe has been preparing meals for the millionaire for a few years now. The millionaire's favorite chocolate cake requires A LOT of baking powder. Chef Joe is sick of making the same chocolate cake and wants to show his skills making new meals, but the millionaire will not let him. Could the baking powder that Chef Joe has to use be the powder found on the jewelry box?

The Scientist
Scientist Amy is studying baking soda for the millionaire. The millionaire wants the scientist to make a big discovery so that the millionaire can steal all the credit. Scientist Amy thinks baking soda is not that exciting and would love to research something else, but the bossy millionaire will not let her. Could the baking soda that Scientist Amy has to study be the powder found on the jewelry box?

The Nanny
Nanny Jan takes care of the millionaire's baby boy. If the baby boy was not the sweetest little guy in the world, Nanny Jan would have quit her job a long time ago! Nanny Jan has to work long hours and the millionaire does not pay her nearly enough! Being a nanny, Nanny Jan goes through a lot of baby powder. Could the baby powder that Nanny Jan uses frequently be the powder found on the jewelry box?

Using your CSI kit, you will test the four suspect powders (cornstarch, baking powder, baking soda, and baby powder) to learn their Physical and Chemical Properties.

When you finish testing the four powders, repeat your experiment with the Evidence Powder found on the jewelry box. You will then compare the properties of the Evidence Powder to the four suspect powders to find only ONE match.

It's your job to clear the names of the three innocent employees and put the guilty thief behind bars! And, hopefully get the millionaire's beloved pearl necklace back!

Participation					
I often contributed good ideas that were relevant to the topic and task. I came to meetings prepared. I did my share of the work.	4	3	2	1	I seldom contributed good ideas. Sometimes I was talking off-task. I did not come to meetings prepared. I did not do my share of the work.
Working with Others					
I often compromised and cooperated. I did take initiative when needed and/or listened and respected the ideas of others.	4	3	2	1	I seldom compromised and cooperated. I did not take initiative when needed and/or did not listen and respect the ideas of others.
Product					
My part of the task is complete and accurate. My work was submitted on time.	4	3	2	1	I did not complete my part of the task. The information I presented was inaccurate and/or not done correctly. It was not completed on time.
Understanding Content					
I can speak about the topic and group work knowledgeably. I can sum-up the lesson.	4	3	2	1	I do not understand what I did in my group. I did not ask or answer questions. I cannot sum-up the lesson.

Substance Suspect	Physical Properties Description	Water Reaction Description	Litmus Paper Description	Vinegar Reaction Description	Iodine Reaction Description
Baking Soda Scientist Amy				Fizzed No Reaction	
Cornstarch Farmer Bob				Fizzed No Reaction	
Baking Powder Chef Joe				Fizzed No Reaction	
Baby Powder Nanny Jan				Fizzed No Reaction	
Evidence Powder Prediction _____ _____				Fizzed No Reaction	

Conclusion: The analysis of the evidence proves that _____ took the necklace. I came to this conclusion because

_____

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	3	2	1
Lab Description	Relevant, telling, quality details give the reader important information that describes the lab.	Supporting details and information are relevant, but one key issue or portion is not described.	Supporting details and information are relevant, but several key issues or portions not described. There is a need for more supporting details.
Data Table	All data is recorded accurately and precisely with no errors.	Most data is recorded accurately and precisely with no more than 2 errors.	Little data is recorded accurately and precisely with 3 or more errors.
Conclusion	Conclusion is thorough and uses specific evidence from background information **and** data.	Conclusion is general and uses some evidence from background information **and** data.	Conclusion is general and uses some evidence from background text **or** data.