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| **Title** | What’s the Matter With Change? |
| **Introduction** | This lesson aligns with the NC Essential Standard for 5th grade students in Physical Science: 5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.  Students will be introduced to how scientists and engineers work together at Biogen, IDEC to develop new medicines. They will view a Power Point and watch a 4 minute video to introduce them to how Biogen, IDEC develops medicines through Cell Culture Development. (This lesson is not about cells or cell culture.) This is a springboard for the lab activities the students will do in class. The students will have the opportunity to be a scientist or engineer during the lab activities. Watching the Power Point & video will give the students an opportunity to see that what they are learning in class has applications to what scientists and engineers are doing in labs.  The focus of this lesson is for students to obtain a better grasp of what matter is and how it changes. The essential questions for the lesson are:   * What is matter? * How can we describe matter? * How can matter be changed? * How can we describe the changes that take place in matter?   As students go through the lab activities, they will have several opportunities to make connections between matter, properties, and changes. They will use an analysis sheet to record their observations of the changes as they are occurring.  Students will focus on the writing standard: W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. They will use the same type of Process Flow Diagram that scientists and engineers at Biogen, IDEC use when they are conducting their experiments. A process flow diagram (PFD) tells a person step by step what needs to be done. It is like a recipe with ingredients & directions listed.  Students will be developing 21st century skills.   * Collaboration: students will work in small groups, have small group discussions, and whole group discussions * Critical thinking skills: students will work on a sequencing activity, use their observations to figure out a problem with one of their activities * Creativity: students will use brainstorming lists   Communication: students will write a Process Flow Diagram (PFD), students will share observations and findings in small group and whole group discussions |
| **Real Science Application** | STRUCTURE OF MATTER The things of the physical world seem to be made up of a stunningly varied array of materials. Materials differ greatly in shape, density, flexibility, texture, toughness, and color; in their ability to give off, absorb, bend, or reflect light; in what form they take at different temperatures; in their responses to each other; and in hundreds of other ways. Yet, in spite of appearances, everything is really made up of a relatively few kinds of basic material combined in various ways. As it turns out, about 100 such materials—the chemical elements—are now known to exist, and only a few of them are abundant in the universe.  When two or more substances interact to form new substances (as in burning, digestion, corrosion, and cooking), the elements composing them combine in new ways. In such recombinations, the properties of the new combinations may be very different from those of the old. An especially important kind of reaction between substances involves combination of oxygen with something else—as in burning or rusting.  The basic premise of the modern theory of matter is that the elements consist of a few different kinds of atoms—particles far too tiny to see in a microscope—that join together in different configurations to form substances. There are one or more—but never many—kinds of these atoms for each of the approximately 100 elements.  There are distinct patterns of properties among the elements. There are groups of elements that have similar properties, including highly reactive metals, less-reactive metals, highly reactive non-metals (such as chlorine, fluorine, and oxygen), and some almost completely nonreactive gases (such as helium and neon). Some elements don't fit into any of these categories; among them are carbon and hydrogen, essential elements of living matter. When the elements are listed in order by the masses of their atoms, similar sequences of properties appear over and over again in the list. **Science For All Americans *4D*** <http://www.project2061.org/publications/bsl/online/index.php?home=true> |
| **Curriculum Alignment** | NC Essential Standards   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Content Area | Grade Level | NC SCS | Lesson 1 | Lesson 2 | Lesson 3 | | Science | 5 | 5.P.2.3 | X | X |  |   Common Core Standards   |  |  |  |  | | --- | --- | --- | --- | | Content Standard | Lesson 1 | Lesson 2 | Lesson 3 | | W.5.4 | X | X |  | |
| **Learning Outcomes** | * Students will learn the definition of matter. * Students will learn how matter can be changed. * Students will learn about physical and chemical changes. * Students will learn how to read and write a Process Flow Diagram (PFD). * Students will report on a lab activity by stating facts and citing evidence to document their claims. * Students will use the appropriate scientific vocabulary while reporting and writing their observations. |
| **Time Required and Location** | All Lessons are in the classroom  Day before lesson: (10-20 minutes)  Day 1 (30 minutes)  Day 2 (50 minutes)  Day 3 (60 minutes)  Day 4 (30-60 minutes)  Day 5 (30-60 minutes)  Day 6 (30-60 minutes) |

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| **Materials Needed** | **Teacher List:**   * 9 oz. clear cups (1 per group and must be clear) * Water * Baking soda (1 small box/group) * Vinegar (1 bottle/per group) * Measuring spoons (1/8, ¼, ½ 1 tsp. 5 of each) * Measuring cups (1, 1/2 , ¼, 1/3 cups; 5 of each) * Mixing spoons (5 for mixing Kool-Aid) * Purple Kool-Aid (Cover directions on the back of the packages) * ½ to 1 lb. sugar (divide this among groups) * 5 2 qt. pitchers * Cups (20 or more small paper cups in case they want to try the Kool-Aid) * Bulletin board paper to cover work area (floor & table) * Gloves * Goggles * Performance Tasks Instructions * Class Set of Blank Process Flow Diagrams * Items for Performance Task #2 * Class set of charts for Performance Task #2 * Class Set of “Doubtful Reporter” Scenario & rubrics | ***Student List: per group for Product Z Activity***   * 1 9 oz. clear cup * 1 box baking soda * 1 bottle of vinegar * Measuring spoons (1/8, ¼, ½ 1 tsp. * Measuring cups (1, 1/2 , ¼, 1/3 cups * Gloves * 1 PFD * 1 Observation/Recording Sheet   ***Student List: per group for GrapeX Activity:***   * 1 Mixing spoon * 1 package Purple Kool-Aid * 1 Ziploc bag with sugar * 1 2 qt. pitcher * Measuring cups (1, 1/2 , ¼, 1/3 cups * Gloves * 4 small paper cups * 1 PFD (original copy) * 1 Observation Sheet * 1 PFD (revision copy) |
| **Safety** | American Chemical Society: Safety in the Elementary Classroom <http://www.acs.org/content/acs/en/education/policies/safety.html> Find SDS sheets attached | |
| **Student Prior Knowledge** | * Understand properties of solids and liquids and the changes they undergo. * Understand the structure and properties of matter before and after they undergo a change. * Compare solids, liquids, and gases based on their basic properties. * Understand the composition and properties of matter before and after they undergo a change or interaction. * Compare the physical properties of samples of matter (strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted by magnets, reactions to water and fire). * Understand how to measure properly. | |
| **Teacher Preparations** | * Gather all the materials & equipment described in the above list. * Break this into teacher preparation by activities & days. * Read the safety guidelines for vinegar, baking soda | |
| **Activities** | **What’s the Matter with Change?**  5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.  W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.  Essential Questions:   * What is matter? * How can we describe matter? * How can matter be changed? * How can we describe the changes that take place in matter?   Big Ideas:   * Matter has mass and takes up space. * Matter can be described by its’ properties: strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted by magnets, reactions to water and fire * Changes in the properties causes changes in matter. * When two or more materials are combined then a new material is formed. * Physical changes in matter can be reversed. Chemical changes in matter cannot be reversed.   Before lesson: (10-20 minutes)   * Give students the pre-assessment.(Assessment 1) * The formative assessment probe, Sugar Water p. 11, from Page Keeley’s Uncovering Student Ideas in Science Vol.4 can also be given to help with planning purposes.   **Day 1: Engage**: (30 minutes total)   * Ask student if they know how medicine is made. * Show the power point: “Developing Medicine by Making Physical and Chemical Changes to Matter”   **Teacher Notes:**   * + The PowerPoint is meant to help students begin to understand how items we take for granted has been changed in some way.   + This video has 2 small clips.   + The first one is from a Sesame Street clip called “Doctor Please”. It shows the characters in the doctor’s office sneezing, coughing, etc.   + The second one was made by Biogen, Idec. & it shows the scientists discussing the process of making medicine. This video is not made for elementary students so they will not understand everything that the scientists are explaining. However, the video is important for the students to see because it shows scientists in the labs doing the procedures. Also, note that there are women in the role as scientists. This is a good video to show and give the students exposure to the biotech industry. (Video is only 4 minutes long) Discuss what the scientists are doing in the background. Also, discuss safety equipment: goggles (Students will be required to wear these & gloves) * Tomorrow we will start our first day a scientists.   Day 2: **Explore:** (50 minutes)   * Divide students into groups. Hand out the job roles sheet & let them pick their roles.(Form 1) (5 min) * Hand out the Lab Activity 1.1: Producing a Process Flow Diagram (PFD) for GrapeX & review it with the students. (1 copy per group). (W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.) * Scientists have to be very detailed when writing procedures for their experiments. The students are going to practice how to write detailed procedures by filling out the procedure section. * Give students 5 minutes to write the PFD. The teacher should be the facilitator. Refrain from giving them suggestions or hints. That will come later. * Have students exchange with another group. * Give the group 2 minutes to read over the previous group’s instructions. Have them discuss whether or not they can make GrapeX by following the other group’s directions. * Teacher will ask each group if they think they can make the GrapeX. Write these questions on the board:   + What kind of container will they use?   + How much water will they use?   + How much sugar will they use?   + Where did they get the water?   + How much GrapeX powder will they use?   + How long will the mix it?   + What will they mix it with? * Return the PFDs back to the original group. Give them 5 minutes to do their revisions. * Have groups exchange the PFDs again. * Give students 10 minutes to get the materials and make the GrapeX following the other group’s directions. * Tell students they must follow the directions they are given. If the directions do not tell them how much of an ingredient to use, then they must stop. (*The goal for this activity is for the students to understand the importance of writing clear & precise instructions.)* * If a group can’t make the GrapeX, Scientist II write on the PFD exactly where they stopped & why they had to stop. * Scientist III fills out the observation sheet (Lab Activity 1.1a) as the group makes GrapeX. * Teacher then asks each group if they were able to make the GrapeX. If they couldn’t, then identify the problem & a solution. (5-10 minutes) * Have students return the PFDs to the original group * Give the group a new copy of the PFD so they can rewrite the procedures again. (10 minutes) * Have students clean up their area.   Day 3: (20 minutes)   * **EXPLAIN**: Ask students the following questions using the GrapeX activity to make connections.   + What is matter? *Matter has mass and takes up space.*   + What are the 3 states of matter? *Make connections between ingredients and matter. Solids are the powder and sugar. Liquid is the water. For this activity there is no gas.*   + What are properties of matter? *Matter has many properties and can be changed. Changes in matter can be described in terms of physical and chemical properties. When a new material is made by combining two or more materials, it has properties that are different from the original materials.*   + What are physical properties? *Appearance, texture, color, smell, melting point, boiling point, and size are all ways to identify physical properties.*   + What are chemical properties? *The identity of the object changes and makes something new. Wood is burned it is turned into ash. The ash can’t be turned back into wood.*   + There are 2 types of changes that occur with matter. *Physical & Chemical Change*   + Yesterday you mixed the GrapeX and sugar with the water and changed how the water looked and tasted. What kind of change do you think occurred? *A physical change because we can actually undo what we have done. The identity of the object does not change.*   + Is the sugar still in the water? How do you know? *Most will say because the GrapeX tastes sweet.* Then ask, “What if it didn’t taste sweet?” How would you know it was there? *If we boil the water until it evaporates, the sugar and powder will still be there.* * Tell the students that tomorrow they will begin working with a team of scientists to help Biogen develop a new medicine called Product Z.   Day 3 **Explore**: (60 minutes)  Making Product Z:   * Give each group the How Much Food? (Lab Activity 1.2) scenario: * Students will work in same groups as the previous day. * Give each group a copy of the Lab Activity 1.2a: Process Flow Diagram (PFD) for Product Z * Give each group an observation recording sheet.(Lab Activity 1.2b) * Tell Scientist III that his job is to record the group’s observations as they are going through the procedures. (It is very important for the observation recording sheet to be filled out as they are working. This will help them observe the changes and be ready for the class discussion.) (5 minutes) * Explain to the students that the water represents nutrients and the baking soda represents the special nutrients or “food” to grow the cells. The vinegar represents the cells. They are making the broth. (This will reinforce 5.P.2.3) (5 minutes) * Give students 10 minutes to complete this procedure. * Come together as a whole group to discuss the dosages & observations for each group. (10 minutes)   + Each groups shares their recommended dosage and the observation of changes that were occurring.   + Write the dosages for each group on the board. Since groups are using different sizes of teaspoons, this will be a good exercise in comparing fractions. Have students turn and talk to a partner to discuss what they think the right amount is. Then share have them share out what they think the right amount is.   + Then the whole class will decide how much food to feed the cells.   + Remember, the teacher is to facilitate only. This is a good time to let students practice citing evidence and talking about the math involved. This is also a good formative assessment to determine how well students understand comparing fractions and equivalent fractions. * After a consensus is reached, the teacher will then conduct the experiment for the whole class to determine if they have discovered the right dosage.   \*\*If time is short, then the lesson can stop after the teacher demonstration & pick up here the following day.   * **EXPLAIN:** Discuss the changes that occurred: (This will reinforce 5.P.2.3 and is a formative assessment) (20 minutes)   + What are some examples of the matter in Product Z?   + What happened after you mixed the water & vinegar?   + What happened after you put the baking soda in the water & vinegar?   + Did a change occur? What kind of change? *A chemical change because it causes a reaction that produces carbon dioxide (the bubbles). Compare it to when they open a soda for the first time or shake it up. Chemical changes to matter can’t be “undone” You can’t take the vinegar out of the baking soda. There are 5 indicators of chemical change: color change, temperature change, light change, gas is produce, or odor is produced.*   + Make the connection that they are able to give evidence to answer questions because they have documented it on the observation recording sheet.   + Have students make a T-Chart in their science notebooks. At the top write the essential question: “How can matter be changed?” Draw a line down the center of their paper. On one side, have them write physical changes and then the definition under the word. On the other side, have them write chemical changes and then the definition under the word. Then they draw a line under the definitions. Under that line they write the word examples. They will write down examples of each type of change in the correct columns.   + Show students the 4 minute video clip from Study Jams called Physical and Chemical Changes of Matter.   <http://studyjams.scholastic.com/studyjams/jams/science/matter/changes-of-matter.htm>   * + While the students are watching the video clip, they can write examples for each of the changes.   + Homework: Changes in Your Environment (Form 2) * Physical or Chemical Checklist (attached)   Day 4-6: **Evaluate**: Performance Task Scenario and/or Summative Assessment  (All performance tasks cards, charts, and instructions are attached.)   * The 3rd grade teachers will be teaching a unit on Matter: Properties & Change. The have asked the 5th grade teachers for some ideas. Since they have just taught the unit, the teachers suggested that some of the 5th grade students could help teach the unit. Therefore, all 5th grade students must submit a portfolio to demonstrate their understanding of matter, its properties, & how matter can be changed. Three items must be in the portfolio:   + A Process Flow Diagram (PFD) written by the student to demonstrate the importance of following procedures when conducting experiments. The PFD will also be used to demonstrate the student’s knowledge of how to change matter.   + A document showing that you understand the difference between physical and chemical changes. You will be given different items and asked to identify what type of change it has undergone. Then you will be asked to explain how you know that the item went through this change.   + A letter written to a reporter that explains that fifth graders can understand the physical and chemical changes. * Summative Assessment (Assessment 2) * Student self-assessment for science journals. Give each student a copy of the “I Can” Statement (Assessment 3) sheet to complete in class. Instruct them they are to use examples from the lab activities to help them with the checklist. (This can be given as a differentiated assessment for the Summative Assessment.) * \*Have guests come in so students can explain tasks 1 & 2.   **Extend:**  The following are extension activities that can be done with the students. They can be adapted to fit your needs.   * Poppin’ Fun with Physical and Chemical Changes Grades 6-9   <http://www.readwritethink.org/classroom-resources/lesson-plans/poppin-with-physical-chemical-31050.html?tab=3#tabs>   * Science Matters   <http://sbsciencematters.com/lesson-units/5th-grade/>   * Department of Education: Georgiastandards.org-Science Survivor Activity   <https://www.georgiastandards.org/Frameworks/GSO%20Frameworks/5%20Science%20Framework%20Chemical%20and%20Physical%20Changes.pdf> | |
| **Assessment** | Formative Assessments:  Pre-Assessment  Changes in Environment  T-Chart  Summative Assessments:  Summative Assessment-writing explanations to questions  3 Performance Tasks:   1. Writing their own Process Flow Diagram 2. Identify changes in matter and explaining the changes 3. Doubtful Report Letter: Letter explaining that 5th grade students can learn about matter, physical and chemical changes, and give examples.   I Can Statement checklist  Performance Tasks- Summative Assessments  The 3rd grade teachers will be teaching a unit on Matter: Properties & Change. The have asked the 5th grade teachers for some ideas. Since they have just taught the unit, the teachers suggested that some of the 5th grade students could help teach the unit. Therefore, all 5th grade students must submit a portfolio to demonstrate their understanding of matter, its properties, & how matter can be changed. Three items must be in the portfolio:   1. A Process Flow Diagram (PFD) written by the student to demonstrate the importance of following procedures when conducting experiments. The PFD will also be used to demonstrate the student’s knowledge of how to change matter. 2. A document showing that you understand the difference between physical and chemical changes. You will be given different items and asked to identify what type of change it has undergone. Then you will be asked to explain how you know that the item went through this change. 3. A letter written to a reporter that explains that fifth graders can understand the physical and chemical changes. 4. Have guests come in so students can explain tasks 1 & 2.   The second task should be set up in a science center. Have materials that the students must separate into physical and chemical changes. Then explain how they know the materials went through those changes.    Materials Needed for each Performance Task:   1. Performance Task Card & a blank PFD. 2. Physical & Chemical chart. Balled up aluminum foil, torn up paper, clay shaped in some way, frozen water bottle, melted butter, tarnished silverware, rusty nails, antacids, a picture of hydrogen peroxide with bubbles, a lit match, sour milk (find pictures of these & include them) (Make chart with explanation part & directions.) 3. Doubtful Reporter Letter | |
| **Critical Vocabulary** | Matter  Physical Change  Chemical Change  Change  Process Flow Diagram (PFD)  Procedures  Properties | |
| **Extension Activities** | * Changing the temperature of the water as the independent variable instead of the baking soda. | |

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| **References** | American Association for the Advancement of Science Science For All Americans: Benchmarks for Science Literacy <http://www.project2061.org/publications/bsl/online/index.php?home=true>  Chitman-Booker, L., & Kopp, K. (2013). *The 5Es of Inquiry-Based Science.* Huntington Beach: Shell Education  Customized CTS: K-12 Matter: Properties and Change Strand for NC Science Essential Standards <http://scnces.ncdpi.wikispaces.net/Customized+Curriculum+Topic+Study+Guides>  Framework for K-12 Science Education Core Idea PS1: Matter and Its InteractionsPS1.A: Structure and Properties of MatterPS1.B: Chemical Reactions  Keely, P. (2008). *Science: Formative Assessment.* Thousand Oaks: Corwing Press.  RP Matter and Energy Grade 5: Teacher Resource Pack <http://scnces.ncdpi.wikispaces.net/K-5+Science+Resources>  Vasquez, J. A., Sneider, C., & Comer, M. (2013). *STEM: Lesson Essentials Integrating Science, Technology, Engineering, and Mathematics.* Portsmouth: Heinemann.oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-111-990 |
| **Supplemental Information** | * [**Investigating Changes of State: Chemical and Physical Changes**](http://serc.carleton.edu/sp/mnstep/activities/20101.html)oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-025   <http://serc.carleton.edu/sp/mnstep/activities/20101.html>  In this activity students explore and identify chemical and physical changes by observing a variety of changes in matter in lab stations and through the making of butter and pancakes.   * [**Physical and Chemical Changes**](http://ia.usu.edu/viewproject.php?project=ia:15350)   <http://ia.usu.edu/viewproject.php?project=ia:15350>  Physical and chemical changes in matter affect us every day. Use the following resources to help you understand these changes more completely.   * [**Chemistry: classifying chemical and physical changes in various materials/substances**](http://serc.carleton.edu/sp/mnstep/activities/26440.html) * oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-112-025   <http://serc.carleton.edu/sp/mnstep/activities/26440.html>oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-111-990  This activity is a classroom lab where students observe and classify chemical and physical changes using the five characteristics of a chemical change, interpret their findings, and use evidence to support their findings.   * [**The Magic of Matter**](http://ia.usu.edu/viewproject.php?project=ia:7086)   Discover what matter is, the different kinds of matter, and how it changes. Your assignment - have fun with matter!   * oai:nsdl.org:ncs:NSDL-COLLECTION-000-003-111-990   <http://ia.usu.edu/viewproject.php?project=ia:7086>   * **Bill Nye Phases of Matter (1,2,&3)**   <http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7685>   * **Bill Nye Chemical Reactions (1,2, &3)**   <http://www.gamequarium.org/cgi-bin/search/linfo.cgi?id=7907> |
| **Comments** | This lesson plan is a result of my externship with Biogen, IDEC. I spent several days meeting with my mentor and observing scientists in the lab working on their different experiments. Each scientist showed me how they used the equipment, the procedures for growing and feeding the cells, the Process Flow Diagram and Standard Operating Procedures they use to ensure that they are maintaining the quality of the product. I chose a standard that is vertically aligned to both middle and high school physical science. This lesson will help build a foundation for students to follow lab procedures. More importantly, they will see that what is learned in the classroom has real-world applications. |
| **Author Info** | Kenan Fellow:  I work in Franklin County as a Curriculum Resource Teacher. I taught 5th grade math & science for 6 years, then I was the AIG teacher for 4 years before becoming the Curriculum Resource Teacher (CRT). This is my 3rd year as a CRT. As a CRT, I have been involved in district level professional learning communities for both math and science. I led a science professional learning community that dealt with vertical alignment for elementary science. I have a BS in Geography. I am licensed to teach K-6 and AIG. My email address is [tonistadelman@fcschools.net](mailto:tonistadelman@fcschools.net).  Mentor: Doug Osborne  Senior Manager in the Dept. of Cell Culture Development at Biogen Idec (RTP site)  Degrees:  BS Biochemistry UCLA  MBA University of San Diego  13 year experience at Biogen Idec  3 years research experience at MIT  1 year research experience at Stanford  Email: [douglas.osborne@biogenidec.com](mailto:douglas.osborne@biogenidec.com) |

**Job Roles for Developing New Medicine (Form 1)**

You work at Biogen, Idec with a group of scientists and engineers. Your team is making a new medicine that will help people fight diseases. Follow the PFD to make your medicine.

The job titles and roles for your team are:

* Scientist I is in charge of getting the supplies and equipment for your team. This scientist must initial and date the materials and equipment as well as write down any identifying information on the PFD. He/She is also in charge asking the supervisor questions.
* Scientist II is in charge of completing the procedures to make the medicine. He/She must initial and date the procedures as they are being completed on the PFD.
* Scientist III is in charge of recording the observations on the analysis sheet while the experiment is in process.
* Scientist IV is in charge of verifying that Scientist II performed all of the procedures correctly. He/She must initial and date the procedures after they have been completed on the PFD. This means he watched the Scientist II perform each of the procedures. Also, make sure that everyone has signed the PFD.

\*These are actual job titles at Biogen, IDEC.

# **Lab Activity 1.1: Producing a Process Flow Diagram (PFD) for GrapeX**

5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.

W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

**Product Name: GrapeX**

**Signature reference log for group members**

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| **Name** | **Job Title** | **Initial** | **Date** |
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# **1.0 Materials and Equipment**

**Equipment Log**

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| **Item #** | **Item description** | **Quantity required** | **Collected by: Initial/Date** | **Identifying Information** |
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| 1.1 | 2 qt. pitcher | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.2 | Mixing spoon | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.3 | Measuring cup | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.4 | Drinking cups | 5 | \_\_\_\_\_/\_\_\_\_\_\_ |  |

**Materials Used**

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| **Item #** | **Item description** | **Quantity required** | **Weighed by:**  **Initial/date** | **Identifying information** |
| 1.5 | GrapeX mix (Kool-Aid) | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.6 | Sugar | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.7 | Water | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |

# **2.0 Procedure**

GrapeX Preparation Write any suggestions you have for the group you exchanged your PFD with on the back of this paper.

| **Step #** | **Task**  **Your group writes the directions in this area.** | **Performed by:**  **initial/date** | **Verified by:**  **Initial/date** |
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Names of Group Members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab Activity 1.1a: Observation Sheet for GrapeX**

1. Describe what the GrapeX mix looked like before you poured it into the water.
2. Describe what happened as you mixed the GrapeX with the water.
3. Describe what your completed product looks like.
4. Identify problems with the procedures that you followed today. What were those problems and what could be done to fix those problems?
5. Suppose the GrapeX was a liquid, life-saving drug. Would you trust it to save your life?

**Lab Activity 1.2**

**How Much Food?**

You work at Biogen, Idec with a group of scientists and engineers. Your team is making a new medicine that will help people fight diseases. Right now the scientists are debating how much food they need to feed the cells so that they continue to grow and create the proteins needed for the medicine. The scientists have decided to break into groups of 4 to conduct experiments to determine the right dosage for the cells. Each group will have a PFD that will list all the materials and equipment needed as well as procedures to follow. However, one procedure is missing. It does not list how much food to add to the cells. Each group’s job, is to determine the right dosage for the cells.

* Use only the equipment that is listed on the PFD.
* Use the observation recording sheet to keep track of how much food you have given the cells.
* Describe the changes you see occurring in the container on the observation recording sheet.
* When you have reached the right amount of food, write the dosage on the PFD.

How do you know if you give it too much food?

* If you stir the broth and there is still food (baking soda) left on the bottom of the container.
* In other words, there should **not** be any food on the bottom of the container.

Remember, if the cells get too little food or too much food then they will die. If the cells die, then the company loses money and they have to start all over again. This food is expensive so it is very important that your team uses only as much as needed to keep the cells alive and growing.

After each group has finished their experiment, all the scientists and engineers will form a whole group to discuss what they proper amount of food should be for the cells. The lab supervisor will then conduct the experiment using the proposed dosage to determine if the teams have discovered the right dosage.

# **Lab Activity 1.2a: Process Flow Diagram (PFD) for Product Z**

5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.

W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

**Signature reference log for group members**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Job Title** | **Initial** | **Date** |
|  |  |  |  |
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# **1.0 Materials and Equipment**

**Equipment Log**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item #** | **Item description** | **Quantity required** | **Collected by: Initial/Date** | **Identifying Information** |
| 1.1 | 9oz clear container | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.2 | plastic spoon | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.3 | 100 ml measuring cup | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.4 | 1 measuring teaspoon | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.5 | 1/8 teaspoon | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |

**Materials Used**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item #** | **Item description** | **Quantity required** | **Weighed by:**  **Initial/date** | **Identifying information** |
| 1.9 | water | 100 ml | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.10 | Vinegar | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |
| 1.11 | Baking soda | 1 | \_\_\_\_\_/\_\_\_\_\_\_ |  |

# **2.0 Procedure**

Fill in the blank space after you have completed your experiment.

## Preparation

| **Step #** | **Task** | **Performed by:**  **initial/date** | **Verified by:**  **Initial/date** |
| --- | --- | --- | --- |
| 2.1 | Measure 100 ml of water from the lab sink using the measuring cup. | \_\_\_\_\_/\_\_\_\_ | \_\_\_\_\_/\_\_\_\_ |
| 2.2 | Pour 100 ml of water into 9 oz. clear container. | \_\_\_\_\_/\_\_\_\_ | \_\_\_\_\_/\_\_\_\_ |
| 2.3 | Use the measuring spoon to add 1 teaspoon of vinegar | \_\_\_\_\_/\_\_\_\_\_ | \_\_\_\_\_/\_\_\_\_ |
| 2.4 | Use the plastic spoon & stir for 10 seconds | \_\_\_\_\_/\_\_\_\_\_ | \_\_\_\_\_/\_\_\_\_\_ |
| 2.5 | Add \_\_\_\_\_\_\_\_ baking soda using the measuring spoon | \_\_\_\_\_/\_\_\_\_\_ | \_\_\_\_\_/\_\_\_\_\_ |
| 2.6 | Use the plastic spoon & stir for 10 seconds | \_\_\_\_\_/\_\_\_\_\_ | \_\_\_\_\_/\_\_\_\_\_ |

**Observation Sheet for Product Z**

**Lab Activity 1.2b**

**Group Members’ Names: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Describe what your product looked like at each step of the process.

|  |  |  |
| --- | --- | --- |
| Amount of baking soda | Describe what is happening before you stir the broth. | Describe what the broth looks like after you stir it for 10 seconds. |
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Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Formative Assessment for Matter: Properties & Change

5.P.2.3

Answer the following questions.

1. What is matter?

2. Name the 3 states of matter.

3. How can matter be changed?

4. How can the changes in matter be described?

5. How can we tell if the changes are physical or chemical?

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Answer Key

Formative Assessment for Matter: Properties & Change

5.P.2.3

Answer the following questions.

1. What is matter?

Matter is anything that has mass & takes up space.

2. Name the 3 states of matter.

Solid, liquid, gas

3. How can matter be described?

Physical properties: size, shape, texture, state

Chemical properties:

4. How can the changes in matter be described?

When the properties are changed

5. How can we tell if the changes are physical or chemical?

Physical: Changes can be reversed or undone.

Chemical: Changes cannot be reversed or undone.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Summative Assessment for Matter: Properties & Change**

5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.

Rubric: M-9/9 P-8/9 S-7/9 NI-6/9

Answer the following questions.

1. What is matter?

2. Name the 3 states of matter.

3. How can matter be changed?

4. How can the changes in matter be described?

5. How can we tell if the changes are physical or chemical?

6. David added a little baking soda to a beaker that contained vinegar. Bubbles started coming from the mixture as a gas was released.

Kim said the gas was evidence that the mixture was starting to boil.

Crystal said the gas was evidence that the air in the flask contracted.

Amanda said the gas was evidence that a chemical reaction had taken place.

Linda said the gas was evidence that the vinegar and baking soda expanded.

Who is right? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know this person is right.

7. Austin dissolved a lot of salt in some water in a large flat dish and put the dish in bright sunlight on a hot day. What would Austin see when he returned to the dish after several hours?

Matthew stated the only thing that would be left would be dry salt.

Jonathan disagreed and said the only thing would be water with no salt.

Ben disagreed and said there would not be a change at all. The same salty water would be there when Austin came back.

Which person is right? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know that person is right.

8. Nathan ate a hot dog for lunch. He knew that the hot dog went through some changes but wondered how he could describe them.

Jose said the hot dog went through both physical and chemical changes.

Steven said that the hot dog went through a physical change.

Adam said that the hot dog only went through a chemical change.

Which person is right? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know that person is right.

9. When hot coffee is poured over a cup of ice, the ice begins to melt and mix with the coffee. This is considered to be a physical change. Explain why this is a physical change.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

Answer Key

Summative Assessment for Matter: Properties & Change

5.P.2.3

Rubric: M-9/9 P-8/9 S-7/9 NI-6/9

Answer the following questions.

1. What is matter?

Matter is anything that has mass & takes up space.

2. Name the 3 states of matter.

Solid, liquid, gas

3. How can matter be described?

Physical properties: size, shape, texture, state

Chemical properties:

4. How can the changes in matter be described?

When the properties are changed

5. How can we tell if the changes are physical or chemical?

Physical: Changes can be reversed or undone.

Chemical: Changes cannot be reversed or undone.

6. David added a little baking soda to a beaker that contained vinegar. Bubbles started coming from the mixture as a gas was released.

Kim said the gas was evidence that the mixture was starting to boil.

Crystal said the gas was evidence that the air in the flask contracted.

Amanda said the gas was evidence that a chemical reaction had taken place.

Linda said the gas was evidence that the vinegar and baking soda expanded.

Who is right? \_\_\_\_Amanda\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know this person is right?

The mixing of baking soda & vinegar created a gas which is an indicator of a chemical reaction.

7. Austin dissolved a lot of salt in some water in a large flat dish and put the dish in bright sunlight on a hot day. What would Austin see when he returned to the dish after several hours?

Matthew stated the only thing that would be left would be dry salt.

Jonathan disagreed and said the only thing would be water with no salt.

Ben disagreed and said there would not be a change at all. The same salty water would be there when Austin came back.

Which person is right? \_\_\_\_\_\_\_Matthew\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know that person is right.

The water will evaporate and leave the salt behind. Adding the salt to the water did not create a chemical reaction.

8. Nathan ate a hot dog for lunch. He knew that the hot dog was went through some changes but wondered how he could describe them.

Jose said the hot dog went through both physical and chemical changes.

Steven said that the hot dog went through a physical change.

Adam said that the hot dog only went through a chemical change.

Which person is right? \_\_\_Jose\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Explain how you know.

The hot dog went through physical changes when he was chewing it up. Then it went through chemical changes as it passed through his stomach.

9. When hot coffee is poured over a cup of ice, the ice begins to melt and mix with the coffee. This is considered to be a physical change. Explain why this is a physical change.

This is a physical change because the water from the ice can be changed back to a solid if you freeze it again.

Summative Assessment 3 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**I Can Statements for Matter and Change**

Directions: Circle yes or no for each of the following I Can statements. Make sure to prove that you can do the I Can statements. You may use examples from our lab activities.

|  |  |  |
| --- | --- | --- |
| I can describe matter.  Give a description of matter. | Yes | No |
| I can name and describe two types of changes that occur in matter.  List the two names and give descriptions of each.  1.  2. | Yes | No |

|  |  |
| --- | --- |
| **Physical Changes** | **Chemical Changes** |
| Aluminum foil is cut in half. | Milk goes sour. |
| Clay is molded into a new shape. | Jewelry tarnishes. |
| Butter melts on warm toast. | Bread becomes toast. |
| Water evaporates from the surface of the ocean. | Rust forms on a nail left outside. |
| A juice box in the freezer freezes. | Gasoline is ignited. |
| Rubbing alcohol evaporates on your hand. | Hydrogen peroxide bubbles in a cut. |
|  | Food scraps are turned into compost in a compost pile. |
|  | A match is lit. |
|  | You take an antacid to settle your stomach. |
|  | Your body digests food. |
|  | You fry an egg. |

**Performance Task 1**

**Writing a Process Flow Diagram for Melting Ice**

Write a PFD for how to melt ice. Use the blank PFD template provided. Ask yourself the following questions:

* How would I melt ice?
* What equipment would I use to help melt ice?
* What materials would I use to help melt ice?
* How would I use the equipment and materials to melt the ice?
* How will I write the procedures in a clear way so that everyone will understand them?



**Performance Task 1**

# **Melting Ice PFD**

5.P.2.3: Summarize properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.

W.5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_**

**Directions:** Use this blank PFD to write how you would melt ice. You may not have to use all the spaces. That’s ok! Make sure to number each item.

# **1.0 Materials and Equipment**

**Equipment Log**

|  |  |  |
| --- | --- | --- |
| **Item #** | **Item description** | **Quantity required** |
| 1.1 |  |  |
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**Materials Used (ingredients)**

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| --- | --- | --- |
| **Item #** | **Item description** | **Quantity required** |
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# **2.0 Procedures**

| **Step #** | **Write the directions in this area.** | **What type of change occurs at each step?** |
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Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Performance Task 2**

**Physical and Chemical Change?**

On the table, are items which have undergone some type of change. Your job is to identify what type of change each of the items has experienced. Use the chart provided to list each item, the type of change, and a brief explanation of how you know the type of change.

|  |  |  |
| --- | --- | --- |
| Item | Physical or Chemical Change? | Explanation |
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Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Performance Task 3**

**The Doubtful Reporter**

A reporter from WRAL T.V. station interviewed Douglas Osborne, Senior Manager at Biogen, Idec. The reporter stated that 5th graders were too young to learn about the science needed to make medicine. Mr. Osborne disagreed with the reporter. He stated that at Biogen, scientists change matter in different ways to develop medicine. Mr. Osborne told the reporter that 5th graders were very capable of learning how to describe matter and the ways that matter can be changed. Then he told the reporter that 5th grade students in Franklin County had learned about matter and how it can be changed to form a new material. The reporter isn’t too sure he believes Mr. Osborne so your job is to prove that you can describe matter and how it can be changed. How are you going to do this?

You are going to write a letter to the doubtful reporter and describe the lab activities you performed with your team to learn about matter. You can use the observation sheets from the activities, the T-Chart you completed while watching the video, the Changes in Your Environment Chart, and any other notes that you have taken during class.

Include the following information in your letter:

1. Explain to the reporter the activities you did in class to help you learn about matter and how matter can be changed
2. Describe a PFD and how you followed it to make GrapeX and Product Z.
3. Define matter and the 3 states of matter.
4. Name two types of changes that occur in matter.
5. Describe two types of changes that occur in matter.
6. Give examples of these two types of changes of matter.

Remember, this is a letter so don’t just answer the questions as a list.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_

**Changes in Your Environment**

**(Form 2)**

Instructions: Look for changes at home, in your neighborhood or around school. Remember that there are 2 types of changes. Write what you are looking, what change you saw happening, & what type of change occurred. Fill in 10 different changes you observed.

|  |  |  |
| --- | --- | --- |
| Observation | Change Observed | Type of Change Observed |
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**Rubric for the Doubtful Reporter Letter**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 4 | 3 | 2 | 1 |
| Definition of matter with 3 states of matter listed | Accurate definition of matter and all 3 states of matter listed | Accurate definition of matter and all 2 states of matter listed | Accurate definition of matter and all 1 states of matter listed | No definition of matter and all 3 states of matter listed |
| Name and describe 2 types of changes in matter | Both changes of matter are listed and described. | One change of matter is listed and described. | Both changes are listed but not described | Neither changes are listed or described. |
| Give 1 example of both types of changes in matter | 1 accurate example for both changes in matter | 1 accurate example for one change in matter is given |  | No examples are given for changes in matter |
| Describe what a PFD is and how it is used | Accurate definition of a PFD and how it is used | No definition of PFD but there is an explanation of its use | Definition of PFD but no explanation of its use | No definition is given or explanation of how it is used. |