Teaching Guide

Minecraft: Periodic Rescue

Use this guide in conjunction with the Periodic Rescue world in Minecraft.

Unit Overview

Students will apply chemistry concepts to help scientists recover their research after a radiation storm knocked out power to their research station. Concepts include atomic number, weight, and structure; the relationship between elements and molecules; and the design and organization of the periodic table.

This unit is based on the principles of discovery learning where students learn about basic concepts of chemistry through exploration and experimentation. While students can save their game progress and come back to the world, most students will want to work through the entire scenario from start to finish. After the students "recover" all of the scientists' research, the station unlocks, and students can go outside and explore the planet on their own.

Estimated time: 45-60 min

Unit objectives

- Define atomic number.
- Compare the atomic number with the atomic mass of an element.
- Identify elements as the basic building blocks of matter.
- Describe the design of the periodic table and explain how elements are grouped into families and periods.
- Interpret a diagram that displays information about a specific element.
- Identify areas of the periodic table that group metals, nonmetals, and inert gases.

Unit assessment: Completing tasks in the world unlocks other areas of the world, providing an amount of self-assessment. Students can also create their own scientific journal using the in-game camera and portfolio. Search "how to export a portfolio in Minecraft" to learn how to export a portfolio from Minecraft.

The questions provided in this guide can also be used to assess students' growth toward the unit objectives.

A note on chemical notation: Minecraft does not have the ability to display scientific notation in text. Thus, chemical formulas in the world are written out like equations, e.g., Cl(2) instead of Cl_2.

Game Play

The order in which students complete activities may vary, and this is intentional. While there are a few tasks that must be completed in the correct order, most of the gameplay is left up to the student so they can learn in the way that is best and most interesting for them.

Materials

- Periodic Rescue world
- camera and portfolio (optional)

Vocabulary

- atom
- ion
- element
- molecule

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- periodic table
- metal
- nonmetal
- inert gas
- alkali metal
- radiation

Chemistry Mod for Minecraft

Minecraft has chemistry features and specialized crafting tables. To learn about these features, visit the Minecraft Chemistry site and download the teacher's Chemistry Lab Journal. The specialized crafting tables are as follows:

- Element Constructor
- Compound Creator
- Lab Table
- Material Reducer

Locations and Activities

Since the gameplay is largely left up to students, this section describes each game location and the activities and content in each location. Students have the option of taking pictures of their completed tasks and placing them in their portfolio, for example, taking a picture of their completed periodic table.

1. **Student Ship**
    a. Receive emergency transmission from station.
    b. Put on radiation suit.
    c. Hook up power to the station (outside).
2. **Emergency Shelter**
    a. Meet the research team and learn about the scenario.
    b. Unlock the rest of the station.
    c. Research team is based on real-life people:
        i. Dr. Mae Jemison – first African American woman in space
        ii. Dr. Martyn Poliakoff – chemist, Royal Society of Chemistry
        iii. Dr. Rosalind Franklin – chemist, discovered the structure of DNA
        iv. Dr. Sonia Guimarães – chemist, first Black Brazilian woman to earn a doctorate in physics
        v. Dr. Janaki Ammal – botanist, first woman to earn a PhD in botany in the United States
        vi. Dr. Lilli Hornig – chemist, worked on the Manhattan Project
        vii. Ahmed Zewail – chemist, father of Femtochemistry and Nobel Prize winner for Chemistry
        viii. Eli Kemp – miner, first miner to be killed on Blair Mountain during the Battle of Blair Mountain, WV
    d. As an optional extension activity, students can do research on the scientists.
3. **Farm:** Students can harvest anything on the farm if they need food.
4. **Mine:** Students can mine a variety of resources.
    a. They will first need to craft torches to light up the mine.
        i. After completing the flame test with Ahmed Zewail, students are instructed to mark the different areas of the mine with colored torches.
    b. Picks are available in a chest at the entrance of the mine.
    c. Materials from the mine can be deconstructed into their base elements for use in other tasks.
    d. Some materials have uranium, which will be needed to create fuel rods for the reactor.
5. **Labs of Dr. Poliakoff and Dr. Franklin:** Chemistry crafting tables and periodic table
    a. Dr. Poliakoff tasks (1st level) – introduction to the chemistry crafting tables
        i. Craft hydrogen, helium, and oxygen.

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        ii. Craft water.
    b. Dr. Rosalind Franklin task (2nd level)
        i. Find the missing elements in the periodic table.
        ii. NOTE – To place a missing element in the periodic table, the crosshairs have to be near or touch the block that is either above or below the hole. It might take some trial and error to find the correct spot.
        iii. NOTE – A misplaced block can be mined to remove it.
    c. Side quests
        i. Elephant toothpaste
        ii. Helium balloons
        iii. Birthday cake
6. **Labs of Dr. Guimarães and Intern Ahmed**: Experiments with a lab table
    a. Dr. Sonia Guimarães tasks (1st level) – water reactivity test with alkali metals
        i. Craft or deconstruct materials to find alkali metals.
        ii. Craft water.
        iii. Test each metal for reactivity.
        iv. Place the metals on the brown blocks in order from least to most reactive.
    b. Ahmed Zewail tasks (2nd level) – flame test
        i. Craft or deconstruct elements needed to craft colored torches.
        ii. Craft compounds.
        iii. Combine compounds with torches to craft colored torches.
    c. Side quests
        i. Helium balloons
        ii. Ice bomb
        iii. Sparklers
        iv. Glow sticks
7. **Lab of Dr. Hornig /Reactor:** Research radiation
    a. Dr. Lilli Hornig tasks – collect radioactive elements.
        i. Mine and deconstruct different materials to find out which ones are radioactive.
        ii. Craft a fuel rod to repower the station.
        iii. NOTE – Students need to collect the fuel rod after it is built. The chest does not store them. They can put more than 100 uranium in the chest and the game will continue to count it but the fuel rod chest will only have one rod in it at a time.
8. **Sequential Tasks:** These tasks must be completed in the following order to advance the scenario and complete the world. Note that students can select “I’m finished” on the NPC dialogues without having completed that NPC’s task. Teachers can have students take a picture of their completed task and place it in their portfolio for verification.
    a. Place redstone on the blocks to connect the power to the station.
    b. Talk with Dr. Jemison in the emergency shelter.
    c. Talk with Dr. Poliakoff.
        i. Craft hydrogen, helium, oxygen, and water.
    d. Complete the water reactivity test with Dr. Guimarães.
    e. Craft a fuel rod with Dr. Lilli Hornig.
9. **Epilogue**
    a. Talk to Dr. Jemison to get her to open the reactor.
    b. Craft 4 fuel rods and 2000 gallons of water to power up the reactor, which opens up the last module in the base.
    c. Visit the lonely robot to open the outside.
    d. World is set to creative mode and students can explore and build.

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Questions

1. How does a change in subatomic particles affect an atom's identity?
2. How are electrons arranged in shells?
3. How does the atomic number relate to an atom’s atomic mass?
4. How can you create an isotope of an element?
5. How does the water reactivity test demonstrate the periodic law?

List of jokes and notes around the labs

These are mainly for fun but can be used to illustrate concepts in the lesson.

1. What isotope is making this water so HEAVY?
2. Hey Dr. Poliakoff, so you think you’re funny. What about this one? Did you know that oxygen went for a second date with potassium? How did it go? - Dr. Franklin (Answer: OK2)
3. A chemist walks into a restaurant and says, “Waiter, I’ll have an H2O.” A friend says, “I’ll have an H2O too,” but doesn’t take a drink.
4. I told a chemistry joke to my lab partner, but there was no reaction.
5. I was going to tell a joke about elements, but all the good ones Argon.
6. Once there was a chemist.
   There isn't anymore.
   What he thought was H2O,
   Was H2SO4.

Sandbox Mode

The Periodic Rescue world can be incorporated throughout physical science and chemistry courses. Teachers can instruct students to use the chemistry crafting tables for numerous other experiments and explorations. For example, students can work in pairs and trade off selecting an element or isotope and having their partner create it with the Element Constructor. There are also over 30 different compounds that can be created with the Compound Creator. Check out the chemistry resources on Minecraft Education for more lesson plans and worlds using Minecraft chemistry.

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