

This Is How the World Ends

Coronal Mass Ejections / Space Storms

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Grade Level	9th – 12th Grade	**Time Frame**	2-3 class period(s)
Subject	Science	**Duration**	120 minutes
Course	Earth Science, Environmental Science		

Essential Question

How can understanding potential dangers influence the decisions we make in our everyday lives?

Summary

Students investigate the properties and impacts of coronal mass ejections (CMEs) on the Earth. Based upon the activity, this is best for older students or very precocious younger high school students. A prerequisite would be basic physical science, but can easily be approached early on in an environmental or earth science course.

Snapshot

Engage

Students contemplate how to prepare for a natural disaster.

Explore

Students actively read an article about CMEs using CUS and Discuss.

Explain

Students do research over CMEs for a presentation.

Extend

Students construct a persuasive presentation over CMEs.

Evaluate

Students reflect over their learning in specific strategies.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD303: Find basic information in text that describes a complex data presentation
IOD505: Analyze presented information when given new, simple information

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-ESS1-1: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Oklahoma Academic Standards (Biology)

B.LS4.3.3: Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.

Oklahoma Academic Standards (Biology)

ES.ESS2.4.3: Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the Earth. These phenomena cause a cycle of ice ages and other changes in climate.

Attachments

- CME Article Teacher Helper Handout - Spanish.docx
- CME Article Teacher Helper Handout.docx
- CME Article.pdf
- CME Group Strike Out - Spanish.docx
- CME Group Strike Out.docx
- Lesson Slides—This is How the World Ends.pptx
- Metacognitive Cards - Spanish.docx
- Metacognitive Cards.docx
- Rubric for Coronal Mass Ejection Poster - Spanish.docx
- Rubric for Coronal Mass Ejection Poster.docx

Materials

- Lesson Slides (attached)
- CME Article handout (attached)
- CME Poster Rubric handout (attached)
- Metacognitive Cards handout (attached)
- CME Strikeout handout (attached)
- Student devices with internet access

Engage

Pass out a Strike Out handout to each student.

Appointment Clocks

The handout is written in a way that assumes you've established Appointment Clocks with your students as a grouping strategy. If you haven't done this, consider adding it in. If you don't want to, you'll have to change the narrative of the worksheet a little (in reference to the 12:00 partner, that is).

Display **slide 1**. Once the slide is displayed, if you click again the weather alert tone and message will start to play. When it is complete, move on to the next slide.

Alarms Cause Alarm

The audio of the weather alarm (emergency alert, technically) will be...well...alarming, especially since the students aren't expecting it. That is part of what makes it funny and interesting, but don't let them get too worked up. You're allowed to let them know it is fake.

Have students write down the three things they would gather together at the top of their paper.

When doing Strike Out for this activity, the students will be in pairs. Partners exchange papers and mark, or “strike”, out one thing on their partner's list that they think should be eliminated. Once that happens, the partners will combine their lists to make four things that they will gather when faced with such a dire emergency.

Once the group lists are made, have groups exchange their lists, and continue with the task of striking out one item that they have decided isn't worth keeping. After this has happened twice, the list goes back to the original group. The original group can “reclaim” one item that has been struck out, making a final list of three things they can keep with them when the CME strikes.

Explore

Give Them Time!

One of the biggest issues of modern teaching is feeling like we have to rush through everything. For students to really experience what they're supposed to experience, give them lots of time with the article. It is difficult. Students always take much longer than us, but that's because they are learning what we already know what to do. Recommended time (at minimum): 30 minutes just for this section.

Pass out a copy of the attached article to each student. There is a slide with directions on how to CUS and Discuss as an active reading strategy. The students will:

- Circle words they've never seen before
- Underline details and/or evidence provided
- Star the main ideas the article is sharing

Not For The Faint

This article is definitely not the watered-down version high-school students usually get - this is the real deal. Therefore, it is up to you to scaffold the experience. Don't skip this just because it is 'hard'. Rather, be there for your students through the struggle.

After they are done reading the article, play the video on the slide.

Allow the students to read through the article again after the video. This is to see if they have any additions or insights to clear up some of the questions they had when reading the article.

Helping Hand

If you struggled with reading the article, do not fear. To help you, a teacher helper document is included. This is NOT for the students, but for you as the teacher.

Explain

Explain And Extend

Read and offer both the explain and extend at the same time. If you don't, the explain will come off as just getting on the computer and finding what you find without a real purpose.

Adding onto the article, have students go online and research CMEs, the probability of them, the danger of them, etc. Let them know that the purpose of this research is for the creation of a presentation of sorts, so they should be sure to document important details they plan on using.

Setting Internet Boundaries

We all know that everything on the internet is 100% true... ... ... If you worry about the students' ability to determine what is credible or not, you can either add this in as a teachable moment, or refer your students to this list of websites we've already compiled.

Extend

Tell students that they are going to make a persuasive presentation over CMEs. There is a rubric attached for you to pass out to each student (or pairs of students from the Strike Out activity). The options are as open as you want them to be, and can included - but not limited to:

- Public Service Announcement to educate the public of CMEs in a catchy way
- News or radio broadcast as if a CME has occurred
- Commercial pitching survival item for CMEs (which could relate to the Strike Out activity)
- Two Minute Documentary over CMEs (preferably a la Blair Witch Project, Spinal Tap, Cloverfield, The Office, etc.)

No matter the method, the students must adhere to the rubric, technically be factual, but hopefully be very captivating.

Each group will present their end 'product' to the entire class.

Evaluate

Pass out a copy of the Metacognitive Cards handout to each student. Have students reflect over each component and how each component contributed to learning.

Meta Versus Not Meta

This is a time to reflect over the process of learning. This is NOT a time to summarize what was learned, but it IS a time to reflect how learning happened. This a huge, yet overlooked, part of the complete learning experience.

Side Note: Title And Lesson Picture Inspiration

T.S. Eliot is the guy in the lesson picture. He wrote a poem titled The Hollow Men, and the ending of the poem is "This is how the world ends/Not with a bang, but with a whimper"

Resources

- K20 Center. (n.d.). Strike Out. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5062cdf
- K20 Center. (n.d.). CUS and Discuss. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5073969
- K20 Center. (n.d.). Metacognitive Cards. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f507b085