Today I Learned About Materials

Description:

Our modern world uses many different materials, often complexly constructed and difficult to recycle. Students investigate the elements in a smartphone and innovations in cement and steel. They also consider the challenge of communicating about large and complex numbers.

Skills & Objectives

SWBAT

- Understand that materials science can help reduce the carbon dioxide and other polluting outputs from industrial processes.
- Explain why cement and steel are key to reducing carbon dioxide from industry.
- Give one example of a technique to describe a large number to the general public.

Skills

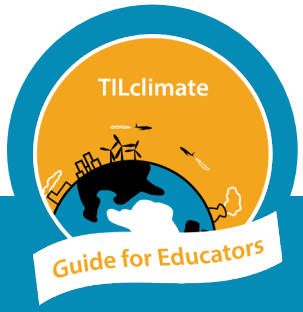
- Communication
- Reading scientific news articles

Students Should Already Know That

- Everyday materials are made from elements, minerals, chemicals, and other materials that must be mined, sourced, produced, and processed.

Standards Alignment:
HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources.
RST.11-12.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
SL.11-12.5 Make strategic use of digital media in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

Disciplinary Core Ideas:
ESS3.A Natural Resources
ESS3.C Human Impacts on Earth Systems
ESS3.D Global Climate Change
ETS1.A Defining and Delimiting an Engineering Problem



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How To Use These Activities:

Pages with the circular "TILclimate Guide for Educators" logo and dark band across the top are intended for educators. Simpler pages without the dark band across the top are meant for students.

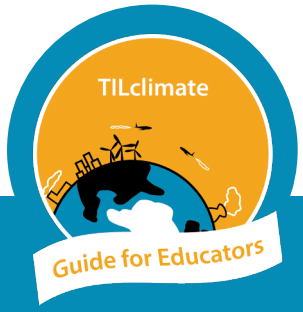
Each of the included activities is designed to be used as a standalone, in sequence, or integrated within other curriculum needs. A detailed table of contents, on the next page, explains what students will do in each activity.

A Note About Printing

All student pages are designed to be printable in grayscale. Larger copies of the infographics on page 2 are included. A few copies of this page could be printed color for students to share, or the image projected in the classroom.

The worksheets do not leave space for students to answer questions. Students may answer these questions in whatever form is the norm for your classroom – a notebook, online form, or something else. This allows you, the teacher, to define what you consider a complete answer.

Podcasts in the Classroom: Throughout these Guides for Educators, we invite students to think about how they would share their learning with family and friends. One way to do this is to encourage your students to create their own podcasts - they're shareable, creative, and have multiple options for embedded assessment. We would love to hear any podcasts or see any other projects you or your students create! Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.



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Detailed Table of Contents

Research Resources

On page 1, students are encouraged to investigate programs that are increasing e-waste harvest safety and fully recyclable devices. In the US, e-waste recyclers can gain certification from two approved organizations, e-Stewards and SERI (R2). Students can find local certified e-waste recycling facilities at:

- https://e-stewards.org/find-a-recycler/
- https://sustainableelectronics.org/find-an-r2-certified-facility/

Development of fully-recyclable electronic devices is ongoing. Internet search terms such as “recyclable phone” or “recyclable laptop” will show the most up-to-date innovations.

For ratings on the repairability of popular smartphones, visit https://www.ifixit.com/smartphone-repairability

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Materials: Sources, Innovations, and Communication

This Educator Guide includes a reading, a group research project, and a communication challenge. Educators may pick and choose among the pieces of the Guide, as suits their class needs.

Parts of this Guide may align with the following topics:

- Physical science: Innovations in materials science. Periodic table of the elements.
- Life/environmental science: Impacts of materials use on climate change and environmental and human health.
- History/social science: History of technological innovations.
- ELA/nonfiction: Communicating large numbers and other complex scientific data.

MIT Resources

We recommend the following as resources for your own better understanding of climate change or as depth for student investigations. Specific sections are listed below:

- Climate Science, Risk & Solutions, an interactive introduction to the basics of climate change. https://climateprimer.mit.edu/
  - Chapter 02 The greenhouse effect and us
  - Chapter 07 Understanding risk
  - Chapter 10 What can we do?

- MIT Climate Portal Explainers are one-page articles describing a variety of climate topics. New Explainers are added each month. https://climate.mit.edu/explainers
  - Concrete
  - Mining and Metals
  - Greenhouse Gases

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Wrap-Up Discussion Questions

- We often focus on recycling as an eco-friendly action and forget that 'reduce' and 'reuse' come before 'recycle.' In the case of one of the materials you studied, what would 'reduce' and 'reuse' look like?
- What innovations in materials use are the most exciting to you? Which do you think you will see in use soonest?
- Many science communicators focus on talking about impacts and solutions instead of showing graphs, figures, and numbers. How could you reframe the fact(s) you chose above to remove the numbers altogether? What is your goal in sharing this information?
- Have you seen scientific data presented in a way that resonated with you? What did you like about how the communicator(s) chose to present the material?
- Why is it important to communicate about science in a way that is accessible and understandable to everyone?

Climate Solutions

Climate solutions can be thought of as falling into four categories outlined below. Across all categories, solutions at the community, state or federal level are generally more impactful than individual actions. For example, policies that increase the nuclear, solar and wind mix in the electric grid are generally more effective at reducing climate pollution than asking homeowners to install solar panels. For more on talking about climate change in the classroom, see "How to Use This Guide".

- **Energy Shift**
  How do decision-makers make the switch from carbon-producing energy to carbon-neutral and carbon-negative energy?
- **Energy Efficiency**
  What products and technologies exist to increase energy efficiency, especially in heating and cooling buildings?
- **Adaptation**
  How can cities and towns adapt to the impacts of climate change?
- **Talk About It**
  Talking about climate change with friends and family can feel overwhelming. What is one thing you have learned that you could share to start a conversation?

What solutions are the most exciting in your classes? We would love to hear from you or your students! Images, video, or audio of student projects or questions are always welcome. Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.