

Smartphones & Your Carbon Footprint

Determine the impact of cell phone manufacturing and use on its carbon footprint



Instructional Time:
75 minutes

Introduction

As a major part of our lives, our cell phone is an extension of ourselves. As a metaphorical reference to walking on the sand, the beach, or the snow, we all leave a footprint behind. *Have you considered what type of footprint you are leaving behind when you use your smartphone? Did you know that two-thirds of the world's population, about 5 billion people, currently use cell phones? As the use of smartphones increases, consequently so does the environmental impact of higher carbon emissions. What impact do manufacturing and use of smartphones have on the phones' carbon footprint? These are all things students may not have considered as they use their phone on a daily or hourly basis.*

This lesson allows students to digitally explore environmental connections when mining resources needed for the phone's parts. This lesson also has students create a survey to find out about cell phone use. *Note:* The survey will take a week to administer and will impact how this flows with your class.

This is a sample STEM Connections lesson. Please find more information at <https://explore.avid.org/experience-avid/stem-connections>

Essential Question

How can using the same cell phone longer reduce its carbon footprint?

Lesson Objectives

Students will:

- Build an understanding of the carbon footprint created by personal cell phone use.
- Use survey results to determine the best plan of action to reduce their personal cell phone carbon footprint.

Materials and Resources

Resources below are available in additional formats such as Microsoft and PDF with a subscription to AVID STEM Connections. Links provided below are in a Google format. (If another format is needed, please contact cskeen@avid.org)

Hands-on:

- [Carbon Footprint Presentation](#)
- [iPhone 12 Product Environmental Report](#)
- [Lifecycle of a Cell Phone](#)

Design Thinking:

This lesson explores the indicated stages in the design thinking process:

- Empathize
- Define
- Ideate
- Prototype
- Test

Standards and Goals:

Common Core State Standards:

- ELA-LITERACY.RST.9-10.7 – Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

International Society for Technology in Education Standards:

- 1.3b – Evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.
- 1.3d – Build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.

Next Generation Science Standards:

- HS-ESS3-4 – Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

- [Cobalt in Congo](#) video
- [Alaska Mining](#) video
- [Lithium in Argentina](#) video

Hands-on (continued):

- [Answer Garden](#) (optional)
- [The Secret Life of a Smart Phone](#)
- [5 Tips to Reduce Your Phone's Carbon Footprint](#) (optional)
- [Designing a Survey](#) video
- Teacher Resource: [Basics of a Carbon Footprint](#)
- Personal digital devices
- Markers
- Sticky notes (4 per student)
- Letter-size paper (8½" x 11") for students
- Whiteboard or poster paper for graphic organizer (T-chart)

Minds-on:

- Personal and collective goals
- Decision-making
- Solutions for personal and social problems
- Teamwork and collaborative problem-solving

Teacher Preparation

- Review the Presentation, articles, and other linked resources to ensure you understand the information being given to students.
- To learn more about carbon footprints, review the information on [Basics of a Carbon Footprint](#).
- Determine whether you will have students access texts used with this lesson digitally or create print copies for them.
- Provide access on the Learning Management System (LMS) to the linked articles (included in the slide presentation) for students.

- HS-ETS1-1 – Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

UN Sustainable Development Goals:

- Goal 12 – Responsible Consumption and Production: Economic and social progress to balance the use of the natural environment and resources in a way that continues to support the planet.

Essential Question: *How can using the same cell phone longer reduce its carbon footprint?*

ENGAGE (15 minutes)

Introduction to the Carbon Footprint:

Display *Consider this Big Idea* (Slide 2). Have students turn and talk to an elbow partner to just share their initial thoughts. The intent is to build empathy around how their actions do have an impact outside of their small circle.

Display and read the *Essential Question* (Slide 3) for students.

Display *Carbon Footprint* (Slide 4) to introduce the idea of a **carbon footprint**.

Guide students to complete a quickwrite on paper or in a digital document that matches your course organization, such as a discussion board in an LMS or in a digital breakout room.

Instruct students to individually respond to the following prompt: *What is your definition of a carbon footprint?* They can use the image to help create a definition.

Display *Carbon Footprint* (Slide 5) and ask students to share their quickwrites with an elbow partner and respond to the following questions. (Slide 19 contains the definition of *carbon footprint* and can be shown at this point if students need clarification.)

- How could your daily cell phone use impact your own carbon footprint?
- How much time do you use your phone, and why does your phone use vary?

Instruct students to use a different colored pen or different font color as they circle the responses on their quickwrites that they share with their partner and add 1–2 differences from their individual response compared to their partners in the margins.

Display *iPhone 12 Product Environmental Report* (Slide 6).

Ask students to take 2 minutes to analyze pages 1 and 2 of this report with their elbow partner. Students should discuss how this information adds to their understanding of their carbon footprint in relation to their cell phone use. (Remind them to add to their notes.)

Resources:

[Carbon Footprint Presentation](#)
[iPhone 12 Product Environmental Report](#)

Teacher Tip:

Quickwrites are meant to be a brief way to connect students' previous knowledge with the topic.

Encourage students to write anything that comes to mind in response to the prompt. For this exercise, do not give feedback on grammar or length.

EXPLORE (20 minutes)**Cell Phone Manufacturing Impact:**

Inform students that carbon footprints are categorized into two areas: *manufacturing* and *use*, which includes charging. This segment of the lesson is about manufacturing cell phones.

Display *Manufacturing Impact* (Slide 7) and introduce the guiding question about how manufacturing may impact Cell Phone Carbon Footprints.

Group students in groups of 3. Each group will have 5 minutes to explore the *Lifecycle of a Cell Phone*. Advise students to only skim through the steps in the process. There is no need to visit the supplementary links of videos or outside sources

Guide partners A, B, and C to explore these resources with this guiding question: “What is the impact of cell phone manufacturing on resources and the environment?” (Allow 5 minutes for exploring the sites.)

- [Cobalt in Congo](#) video
- [Alaska Mining](#) video
- [Lithium in Argentina](#) video

Display *20-Word GIST* (Slide 8) and describe the strategy to students. A GIST is a summarizing strategy that requires students to focus on the main ideas of a text and decide what is important without omitting key ideas. GISTs usually have a word limit. (GIST = Generating Intersection of Schemata and Text.)

Instruct students to individually create 10–15 word GISTs on paper or in a platform such as Answer Garden. Once the individual GISTs are written, each group can create a 20-word GIST statement from the most frequent main ideas and key words. The GIST should address the question “What is the impact of manufacturing cell phones on resources and the environment?”

Have students neatly write a final copy of the GIST on 8 ½" x 11" printer paper to post on the walls. Allow 5 minutes for creation of the GIST.

Resources:

[Carbon Footprint Presentation](#)

[Lifecycle of a Cell Phone](#)

[Cobalt in Congo](#) video

[Alaska Mining](#) video

[Lithium in Argentina](#) video

[Answer Garden](#) (optional)

Teacher Tip:

The end of this Explore section can be a place to pause the lesson if you plan to complete the remainder at a different time.

EXPLAIN (20 minutes)**Cell Phone Use – Connecting to Personal Carbon Footprint:**

Remind students that carbon footprints are categorized into two categories: *manufacturing* and *use*, which includes charging.

Prepare a 2-column T-chart graphic organizer on poster paper or a whiteboard in a common classroom space. Title the two columns as *Notice* and *Wonder*. This is where students will sort the responses that they record on sticky notes.

Provide 4 sticky notes to each student.

Display *3 Measures of a Cell Phone’s Carbon Footprint* (Slide 9).

Explain that as students observe Slide 9, they should record one “I Notice...” and one “I Wonder...” on two separate sticky notes. This information comes from “*The Carbon Footprint of Your Phone and How You Can Reduce It*” that is linked here in the resources.

Use *I Notice/Wonder* (Slide 10) as a reminder for students to record their thinking.

Ask students to sort and place the sticky notes on the *Notice and Wonder* graphic organizer you created at the front of the room.

Display *Tips to Reduce the Carbon Footprint* (Slide 11). As you view the embedded link for *The Secret Life of a Cell Phone*, have students repeat the “I Notice” and “I Wonder” on 2 more sticky notes.

Mention to students that there is also a link for *5 Tips to Reduce your Phone’s Carbon Footprint* on Slide 11. This may be helpful for students if they need more ideas and if there is time.

Use *I Notice/Wonder* (Slide 12) as a reminder for students to record their thinking and place their sticky notes on the appropriate *Notice and Wonder* graphic organizer created for the classroom.

Resources:

[Carbon Footprint Presentation](#)

[The Secret Life of a Smart Phone](#)

[5 Tips to Reduce Your Phone’s](#)

[Carbon Footprint](#) (optional)

Teacher Tip:

For a deeper dive into the Carbon Footprint of Your Phone and How You Can Reduce It, students can review the entire webpage. This could also serve as an enrichment for some students.

ELABORATE (5 minutes)**Determine Cell Phone Usage:**

Display *Reflection* (Slide 13) and remind students of the guiding Essential Question, which they will now reflect on: *How can using the same cell phone longer reduce its carbon footprint?*

Display *Personal Connections* (Slide 14) and challenge students to create a three-question survey asking staff and students about personal cell phone use over a 7-day span. Students can work independently or in groups of 2–3.

Ask students to help generate what should be on the survey and how they plan to invite a group to complete the survey. Google Forms, Survey Monkey, or other digital survey options as allowed by your school district or paper/pencil surveys would all work for this. Students may need some support in creating a survey. *Create a Survey* (Slide 15) contains a 5-minute video to help students.

Remind students that they have approximately one week to gather the survey information so there will be enough data to analyze.

Resources:

[Carbon Footprint Presentation](#)

[Designing a Survey](#) video

Teacher Tips:

To save class time, you may want to create a class survey that each student shares out to their contacts. An example survey is located in the Modifications section at the end of this lesson.

The end of this Elaborate section can be a place to pause the lesson and complete the remainder at a different time.

EVALUATE (15 minutes)

This section should be implemented after the survey data has been collected, which is approximately one week after the survey data collection began.

Personal Connections:

Instruct students to discuss within their small groups the data they received from the survey results.

Display *Making Connections to Survey Data* (Slide 16) to direct students' conversations.

- What did you notice about the survey data collected?
- Can the survey data be used to calculate the carbon footprint of your small group?
- Can the survey data be used to calculate the carbon footprint for the whole school or campus?
- How does this survey information help you think about your own personal cell phone usage?

Resources:

[Carbon Footprint Presentation](#)

[5 Tips to Reduce Your Phone's](#)

[Carbon Footprint](#) (optional)

Display *Tips to Reduce the Carbon Footprint* (Slide 17) and bridge the discussion about survey results with a reminder of possible ways to reduce the carbon footprint through personal cell phone use.

Direct students to write a commitment statement as to how they can reduce their phone’s carbon footprint. Students should locate the quickwrite written at the start of this lesson and record their statement on that document.

Display *Commitment Statement* (Slide 18) to support the articulation of their intended actions.

“My current carbon footprint of my phone is _____. I will commit to _____ (action)_____ within the next _____(time) _____ to reduce the carbon emissions from my phone use.”

Teacher Tip:

It would be very powerful to have students write their commitment statements and display them in the classroom or hallway.

VOCABULARY

- **Carbon footprint:** The total amount of greenhouse gasses released by a person, family, building, organization, or company each year
- **Climate:** The weather in some location averaged over a period of time
- **Cycle:** A periodically repeated sequence of events
- **Fossil Fuel:** An energy-producing substance derived from preserved organisms
- **Footprint:** A mark of a foot or shoe on a surface
- **Global:** Involving the entire Earth
- **Global warming:** An increase in overall temperature near the Earth’s surface caused by accumulation of greenhouse gasses
- **Greenhouse effect:** The process by which greenhouse gasses (notably carbon dioxide and methane) in the atmosphere trap heat from the Sun and reflect it back to Earth rather than letting it leave the planet

Vocabulary slides are included in the Presentation that accompanies this lesson.

CAREER CONNECTIONS

- **Agroecology Farmers** apply ecological and social concepts and principles to the design and management of sustainable agriculture and food systems.
- **Assembly Line Home Fabricators** manufacture products using various materials, tools, and their own hands.
- **Climatologists** study weather patterns and trends over a period of time.
- **Geoscientists** study the Earth’s history, function, and interactions of the systems.

Career Connections slides are included in the Presentation that accompanies this lesson.

*See the Occupational Handbook of the Bureau of Labor Statistics for specific career information:
<https://www.bls.gov/ooh/>*

EXTENSIONS AND MODIFICATIONS

Lesson Extension:

- **Social Media Campaign:** Individual students can use their commitment statements to broadcast their intent and actual action(s) taken to reduce their phone’s carbon footprint.
- **Greenhouse Gas Emissions:** Since about 80% of the CO₂ (a greenhouse gas) is generated in the manufacture of phones, students may want to extend their learning about the phone footprint. A topic for them to explore might be “Does it make sense to keep your phone as long as possible and then recycle it vs. reducing usage of the phone?” As a final activity, students could create a poster/advertisement for phone recycling at their school.

Lesson Modification:

- **Cell Phone Use Survey:** Provide student groups with a ready-made Cell Phone Use Survey using questions such as the following:
 - How many times in an hour do you look at your phone?
 - 0–2 times
 - 3–5 times
 - More than 5 times
 - Which apps do you have set to send you notifications?
 - Do you put your phone on “do not disturb” at least once a day?
 - How long have you had your current phone?