



Mobile Minerals

YEAR 8
EARTH AND SPACE SCIENCES



QGC

FUTUREMAKERS



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Future Makers

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC business aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

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EXPLORE - EXPLAIN - ELABORATE

Mobile Minerals

Teacher Resource

Within Part 1 of this activity, students investigate how minerals and the elements they contain provide valuable resources for human activity, including the raw materials for equipment we use on a daily basis. Smartphones have been specifically selected to contextualise learning within this activity. These devices are made from a surprisingly large number of elements mined from mineral deposits around the world.

Although smartphones greatly benefit our lives, their manufacture and disposal can be problematic; ethical and environmental issues related to these problems will be explored by students in Part 2 of this activity.

Detailed step-by-step instructions for Parts 1 and 2 of this activity can be seen below. It is recommended that you use these instructions to guide your students through the activity.

Part 1: My Smartphone is Made of What?!

1. Discuss the following with students:
 - Minerals are made of chemical elements.
 - Some minerals and the elements they contain provide valuable resources for human activity. These minerals and elements are used to make a wide variety of objects that we use on a daily basis, including toothpaste, toasters, cars and even smartphones.
2. Introduce the activity to the class: Students will investigate how elements mined from mineral deposits are used to make smartphones.
3. Distribute copies of the periodic table to students. Ask students to predict which element/s might be used to make an average smartphone, using prior knowledge to justify their decisions. Students can also discuss where/how they think these elements are used within a smartphone.
4. Reveal the elements used to make an average smartphone by reading them out loud. Students could circle the corresponding elements on their periodic table as they are spoken. Ask students to identify how many elements are used to make a smartphone (77 of 118).
5. Inform students that these elements are used in varied quantities to make the screen, case, electronics and circuitry, and battery. Students will work in small groups to investigate which elements are used to make these components, where these elements are obtained and how their properties are related to their use.
6. If desired, model how to complete this activity by using the smartphone case as an example response (see following page). Within the 'Reference' column, students may simply record the website/s from which they gathered information or use a referencing system such as APA.

Elements Used to Make an Average Smartphone: Smartphone Case

Element	Mineral Source/s	Element Properties Related to Use	Major Producer/s	Reference
Aluminium	Can include gibbsite, boehmite and diasporite from bauxite ore	Malleable, light weight and strong Highly rust-resistant Non-toxic	Australia – 76% (Queensland, New South Wales, Tasmania, Western Australia, Northern Territory) China – 48% Brazil – 34%	www.ga.gov.au/data-pubs/data-and-publications-search/publications/australian-minerals-resource-assessment/boxite www.rsc.org/periodic-table/element/13/aluminium

7. Divide students into groups of two to four and assign each group a smartphone component: the screen, electronics and circuitry, or battery. Ask students to circle or underline the component they are working on, before conducting online research to complete the table for their assigned component. Students may then share their findings with other groups who were working on different components (i.e. a group working on the screen, the electronics and circuitry, and the battery may come together to share their information so all have an understanding of how varied elements are used and obtained to make an average smartphone).

Elements Used to Make an Average Smartphone

Aluminium	Gadolinium	Nickel	Sodium
Antimony	Gallium	Niobium	Strontium
Arsenic	Germanium	Nitrogen	Sulphur
Barium	Gold	Osmium	Tantalum
Beryllium	Hafnium	Oxygen	Tellurium
Bismuth	Helium	Palladium	Terbium
Boron	Holmium	Phosphorus	Thallium
Bromine	Hydrogen	Platinum	Thorium
Calcium	Indium	Polonium	Thulium
Carbon	Iridium	Potassium	Tin
Cadmium	Iron	Praseodymium	Titanium
Chlorine	Lanthanum	Radon	Tungsten
Chromium	Lead	Rhenium	Vanadium
Cerium	Lithium	Rhodium	Ytterbium
Cobalt	Lutetium	Ruthenium	Yttrium
Copper	Manganese	Samarium	Zinc
Dysprosium	Magnesium	Scandium	Zirconium
Erbium	Mercury	Selenium	
Europium	Molybdenum	Silicon	
Fluorine	Neodymium	Silver	

Part 2: The Problem with Smartphones

1. Share statistics on global smartphone use with students¹:

- 2014 2.6 billion smartphone subscriptions
- 2015 3.2 billion smartphone subscriptions
- 2016 3.9 billion smartphone subscriptions
- 2017 4.4 billion smartphone subscriptions
- 2018 5.1 billion smartphone subscriptions
- 2024 7.1 billion smartphone subscriptions (estimated figure)

NB: The term 'smartphone subscriptions' refers to the number of smartphones in use at the point of survey. A single smartphone subscription may be shared by multiple people. Alternatively, one person may have multiple smartphone subscriptions.

Students could plot the data on a line graph and/or calculate the percentage increase between each year. Ask students to:

- Discuss why smartphone use has increased over time.
 - Generate possible explanations for any changes in percentage increase across surveyed years.
2. Ask students to brainstorm issues and implications associated with the worldwide use and manufacture of smartphones; these may relate to ethical considerations, sustainable patterns of living and/or environmental issues. A PMI Chart (plus-minus-interesting) could be used to record student responses.
3. Inform students that they will now work to further investigate the negative issues and implications associated with the use and manufacture of smartphones. Divide students into groups of three or six. From the larger article, [Three Ways Making a Smartphone can Harm the Environment](#), distribute one section (*Catastrophic Mine Waste Spills, Ecosystem Destruction or The Most Polluted Place on the Planet?*) to each individual student when working in groups of three, or one section between pairs of students when working in groups of six. (Additionally, if you have sufficient time, students may analyse the full article.)

Ask students to complete the article analysis for their media article. Students then share their responses to the article analysis task with the larger group.

Following this, students complete the human impacts place mat, *Analysing Human Impacts*. Students work within their groups to identify what is being done, and what more could be done, to resolve and/or minimise the effects of the issues described in the media article at an individual, community and global level. Students may like to conduct further research to complete this task.

¹ Ericsson. (2018). Ericsson mobility reports. Retrieved from ericsson.com/en/mobility-report/reports

Curriculum Links

Science

YEAR 8

Science Understanding

Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales (ACSSU153)

Properties of the different states of matter can be explained in terms of the motion and arrangement of particles (ACSSU151)

Science as a Human Endeavour

Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations (ACSHE135)

Science Inquiry Skills

Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSI139)

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSI144)

Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence (ACSI145)

Communicate ideas, findings and evidence based solutions to problems using scientific language, and representations, using digital technologies as appropriate (ACSI148)

Mathematics

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Number and Algebra

Solve problems involving the use of percentages, including percentage increases and decreases, with and without digital technologies (ACMNA187)

General Capabilities

Literacy

Comprehending texts through listening, reading and viewing

Composing texts through speaking, writing and creating

ICT Capability

Investigating with ICT

Managing and operating ICT

Critical and Creative Thinking

Inquiring – identifying, exploring and organising information and ideas

Personal and Social Capability

Social awareness

Ethical Understanding

Understanding ethical concepts and issues

Reasoning in decision making and actions

Cross-Curriculum Priorities

Sustainability

Sustainable patterns of living rely on the interdependence of healthy social, economic and ecological systems. (OI.3)

The sustainability of ecological, social and economic systems is achieved through informed individual and community action that values local and global equity and fairness across generations into the future. (OI.6)

Actions for a more sustainable future reflect values of care, respect and responsibility, and require us to explore and understand environments. (OI.7)

Designing action for sustainability requires an evaluation of past practices, the assessment of scientific and technological developments, and balanced judgements based on projected future economic, social and environmental impacts. (OI.8)

Mobile Minerals

Student Activity

Elements Used to Make an Average Smartphone:
Smartphone Screen – Electronics and Circuitry – Battery

Element	Mineral Source/s	Element Properties Related to Use	Major Producer/s	Reference

Mobile Minerals

Student Activity

Article Analysis

Prediction

Examine the source, date, headline and images. Write three questions you expect to be answered in the article.

First Reading

Underline any words you are unsure about. Use content clues, a dictionary or a group discussion to identify the meaning of these words. Write in replacement words for your underlined words.

Second Reading

Answer the following questions about the article:

- 1. Summarise the article in the 66 word grid below.

2. What resources are being mined, and why?

3. Who is being impacted by the mining activity?

4. What are the consequences of mining these resources?

5. Why was the article written?

6. How did this article surprise you?

7. How does this article make you feel?

8. Return to your original three questions. Were they answered in the article?
If not, how come? How could you find the answers to these questions?

Analysing Human Impacts

