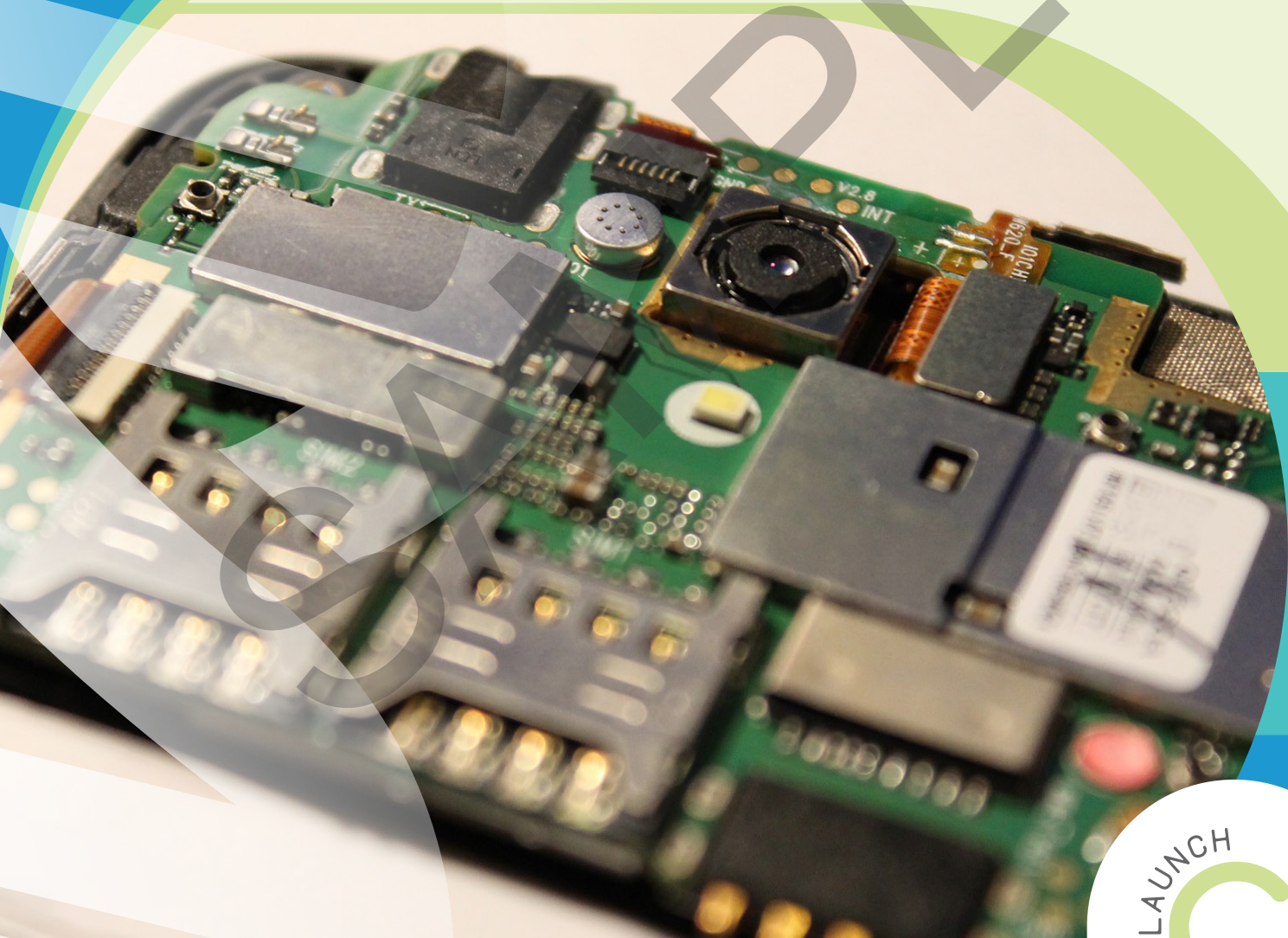


REDUCING RELIANCE ON RARITY



STUDENT WORKBOOK



WHAT'S FOUND INSIDE?

Do you have your own smartphone? Do you think teens should have one? Is it a helpful part of everyday life or does it do more harm than good? Smartphones are a part of our daily lives, with many uses from searching for information, to mapping directions or sending a text message.

I

WE LOVE OUR SMARTPHONES

What can a phone do?

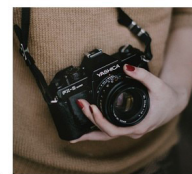
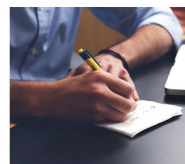
Our smartphones have many features and capabilities that we use for our day-to-day lives. Take a minute to think through all the purposes your smartphone serves. With a smartphone, you can:

- ✓ make and receive phone calls and text messages
- ✓ receive and listen to voicemails
- ✓ browse the internet
- ✓ record and play audio and video
- ✓ create and keep a detailed calendar
- ✓ take, show, and share photos and videos
- ✓ keep record of people's phone numbers, home addresses, email addresses, and other personal information
- ✓ navigate from one location to another
- ✓ look up weather and temperature information
- ✓ take notes by typing or using your voice
- ✓ use it as a stopwatch
- ✓ download and access applications
- ✓ tell the time
- ✓ set an alarm
- ✓ read the news
- ✓ use it as a flashlight
- ✓ calculate numbers
- ✓ follow Home Science Tools on social media



HOME SCIENCE TOOLS
inspired learning

Smartphones
replace many
other common
devices that
were used for
these purposes
in the past.....





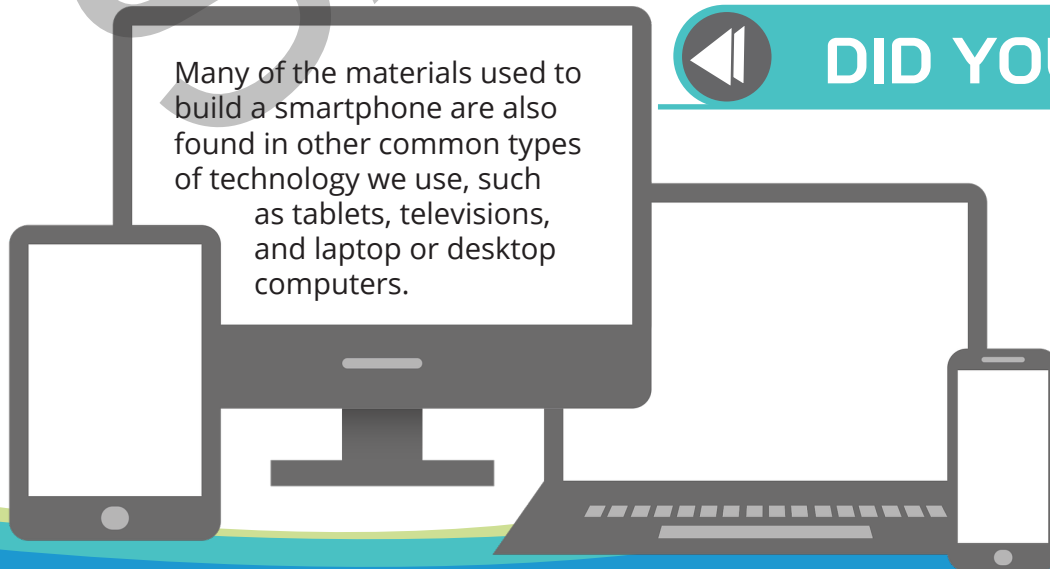
THINK ABOUT IT!

1. In the "Anatomy of a Smartphone" diagram, circle the materials you did not know were used to make a smartphone.
2. Which materials found in a smartphone surprised you the most? Why?
3. How do you think we obtain the materials used in a smartphone?
4. Do you think there are alternative materials we could use to make smartphones? Explain.
5. What are two questions you have about the materials used to make a smartphone or how smartphones are made?

Many of the materials used to build a smartphone are also found in other common types of technology we use, such as tablets, televisions, and laptop or desktop computers.



DID YOU KNOW?



Both tantalum and silver are mined using either method. This is dependent on where the deposits are found. The mining method used is based on the financial costs and ease of access.

Other materials found on the map are less straightforward to obtain. Many of them come from **ores**. An ore is a naturally occurring solid material from which a metal or mineral can be extracted.

For example, potassium isn't mined as chunks of potassium, but instead comes from **potash ore**. Potash is mined using underground mining of evaporated sea floor beds. After the potash ore is extracted from the earth, it is crushed and refined to extract potassium salts, including potassium chloride. From there, the potassium and chloride are separated to produce the potassium used to build smartphones.

The other materials found on the map that we have not yet discussed are indium and germanium, which are both processed from zinc. Zinc, a chemical element, is mined primarily in China through underground mining. After zinc has been mined, it goes through electrolytic refining, which produces indium as a byproduct. Similarly, germanium and gallium are obtained from the **smelting** of zinc ores and through the burning of coal. Smelting is the process of heating and melting metal ores to extract the metals.

Many of the materials used in smartphones, but not found on the map provided by the United States Geological Survey (USGS), are also obtained through ores. Magnesium comes from dolomite ore, which is mined in China, North Korea, Russia, Austria, Greece, and the United States through open-pit mining. Palladium comes from nickel-copper ore mined in Canada and South Africa, also via open-pit mining. Nickel and cobalt are obtained from laterite ore found as weathered deposits in western Australia.

Barium, which is too reactive to be found alone, is derived from barite ore or barium sulfate; these are found in China, India, and Morocco. First, barium sulfate reacts with carbon to produce barium sulfide. The barium sulfide then reacts with hydrochloric acid to produce barium chloride. Finally, through **electrolysis**, the process of using electricity to separate atoms, barium is separated from the chlorine and kept in this form to build smartphones.



Barium sulfate	+	Carbon	→	Barium sulfide	+	Carbon monoxide
BaSO ₄	+	4 C	→	BaS	+	4 CO

Barium sulfide	+	Hydrochloric acid	→	Barium chloride	+	Hydrogen sulfide
BaS	+	HCl	→	BaCl ₂	+	H ₂ S



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Kit	SU-REDUCE
Instructions	IN-REDUCES
Revision Date	3/2022