Properties of Substances

Science Grade-Level Expectations
This instructional task addresses content related to the following science grade-level expectation:

PS-M-A3 Identify the physical and chemical properties of various substances and group substances according to their observable and measurable properties (e.g., conduction, magnetism, light transmission, and density) (GLE 4)

Contents
Teachers may choose to use or modify this tool as part of an instructional lesson or as a formative or summative assessment.

	Objectives
Task	- Read and interpret data - Use properties to identify unknown substances - Group substances based on properties - Support responses with evidence - Make decisions based on scientific data
Sample Exemplar Student Response	

Task

Use the data on the table below to respond to the questions on the following pages.

Table 1: Physical and Chemical Properties

Key: X indicates the property not present: ☐ indicates the property is present

Substance	Physical Properties							Chemical Properties			
	State	Color	Odor	Luster	Conducts heat & electricity	Can be molded	Boiling point	Flammable	Level of Reactivity	Hazardous	Reacts with water
Arsenic	S	gray yellow	X	X	X	X	615 °C	X	average	☐	X
Calcium	S	white	X	☐	☐	X	1484 °C	X	average	X	☐
Carbon	S	black	X	X	X	X	4827 °C	☐	low	X	X
Gold	S	gold	X	☐	☐	☐	2000 °C	X	low	X	X
Oxygen	G	none	X	X	X	X	-252.8 °C	☐	high	X	X
Iron	S	gray	X	☐	☐	☐	2861 °C	X	high	X	☐
Chlorine	G	green	☐	X	X	X	-34.6 °C	X	high	☐	X
Iodine	S	purple, black, or rusty	X	☐	X	X	184 °C	X	average	X	X

Properties accessed at http://www.lenntech.com/periodic/elements/ca.htm.

A. Based on its properties, which substance in Table 1 would be most suitable for both construction and cookware? Support your response with data from Table 1.

B. Based on its properties, which substance in Table 1 would require strict safety precautions when working with it? Support your response with data from Table 1.

C. The table above contains 3 metals. Two of them are iron and gold. Based on the information in the table, what other substance would be classified as a metal? Support your response with data from Table 1.

D. Read the news article Limb Lengthening System Adds Inches to Athlete's Shorter Leg from ABC. Consider why titanium can be used in medical procedures such as bone lengthening and hip joint replacement. Identify three properties titanium has that make it a good substance for medical procedures and explain why each property is important.

Sample Exemplar Student Response:

A. Iron is suitable for construction and cookware. It can be formed when heated, and it conducts heat. Gold would also be a good substance for construction and cookware, as it also conducts heat and can be molded. However, gold is very expensive so it is not normally used for these purposes.

B. Chlorine gas is the most dangerous. It is a gas, which means that it has no certain shape or size. It is highly reactive and hazardous.

C. Calcium can be grouped as a metal because the data chart indicates that is has shine/luster and conducts heat and electricity. These are properties of most metals.

D. Titanium is very strong which allows it to hold up body weight or work in a joint with movement. It can withstand high pressure for a person to be able to walk and put pressure on the leg or joint frequently. Titanium is durable, which is important because patients would not want frequent surgeries to replace the artificial body part. Titanium is not highly reactive. This is important because anything put into a human's body should not corrode, rust, or react with body fluids. Titanium is also a lightweight material and withstands a high range of temperatures before melting.