

## Student Pages

### Forensic Metallurgy – A Challenge in Basic Measurements

Before metal working was mastered, people had to barter or trade to get what they needed from others. Metals made money possible since they were universally valued and could be minted into coins.

Today, farmers in some countries routinely discover old coins that were buried long ago. Such coins can sometimes be purchased online for as little as a dollar a piece. Most of these are copper or bronze but sometimes they turn out to be a more precious metal.

**Problem:** Discover what type of metal was used to make a coin.

**Procedure:**

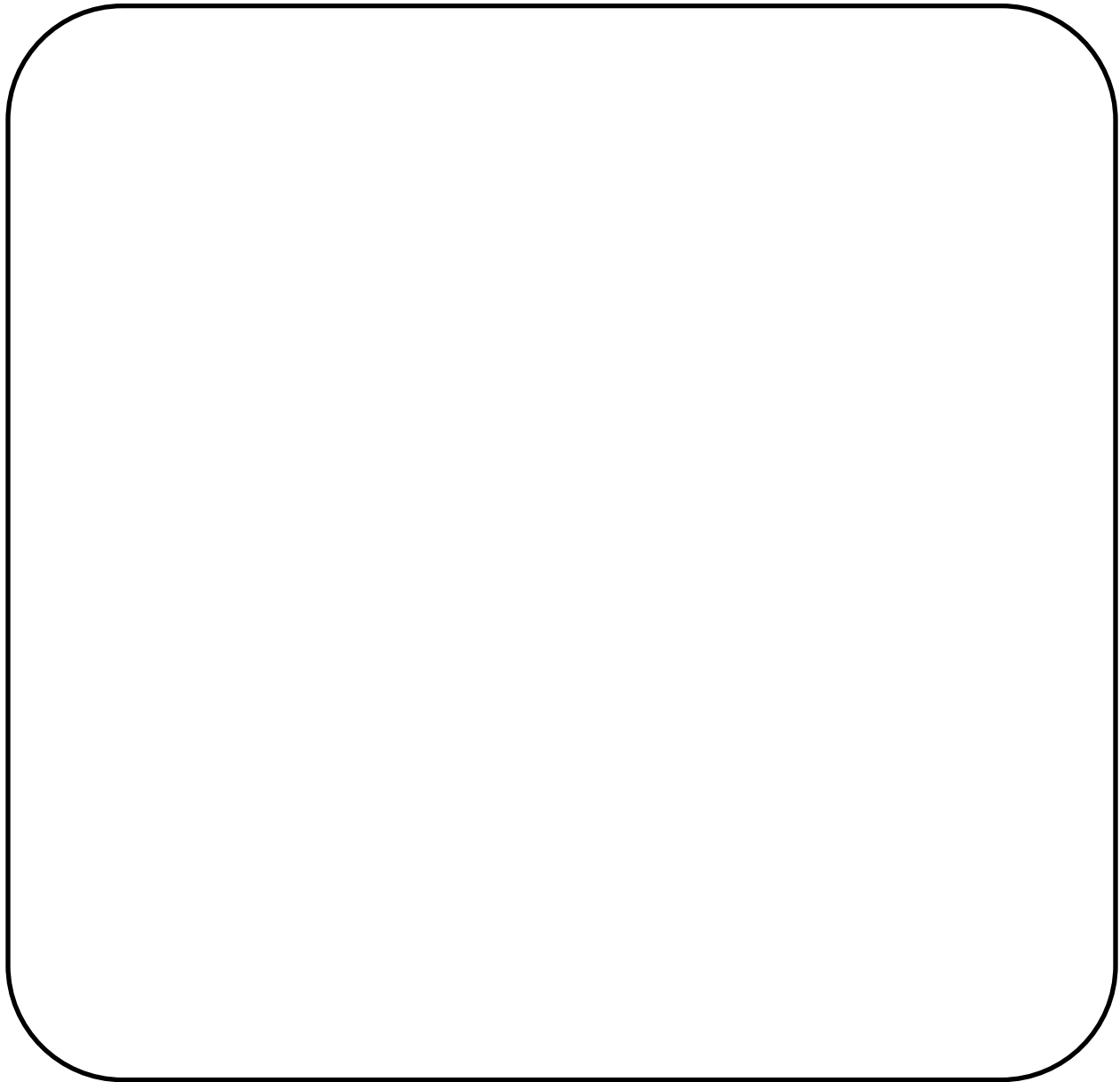
1. Form groups of two for this activity. Your teacher will give you a coin. Treat it carefully. The coin is from China and may be over a thousand years old. Your goal is to determine the metal (or metals) from which the coin was made without damaging it in any significant way.
2. Examine your coin with a hand lens and record your observations below:



3. Devise one or more tests which you could perform on the coin to help you determine which metals are present. Tests must not do any serious damage to the coin. A few

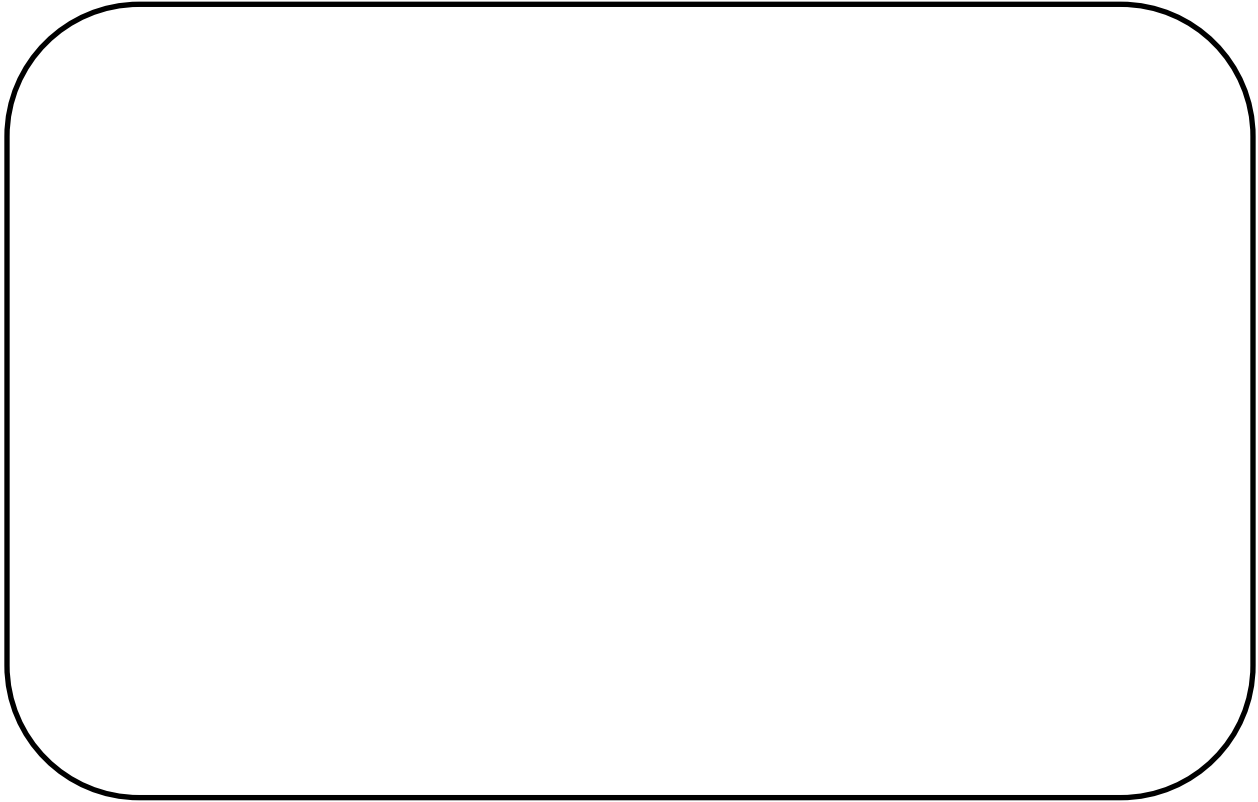
small scratches are ok. A table of materials properties for some common materials is included for your reference on the last page of this handout.

Your teacher will have some basic equipment available for you to use. You may examine this equipment for ideas but don't do any testing yet. Write a procedure for your testing below. Be very specific about what you will do and what type of data you will record. Be ready to justify your plans.

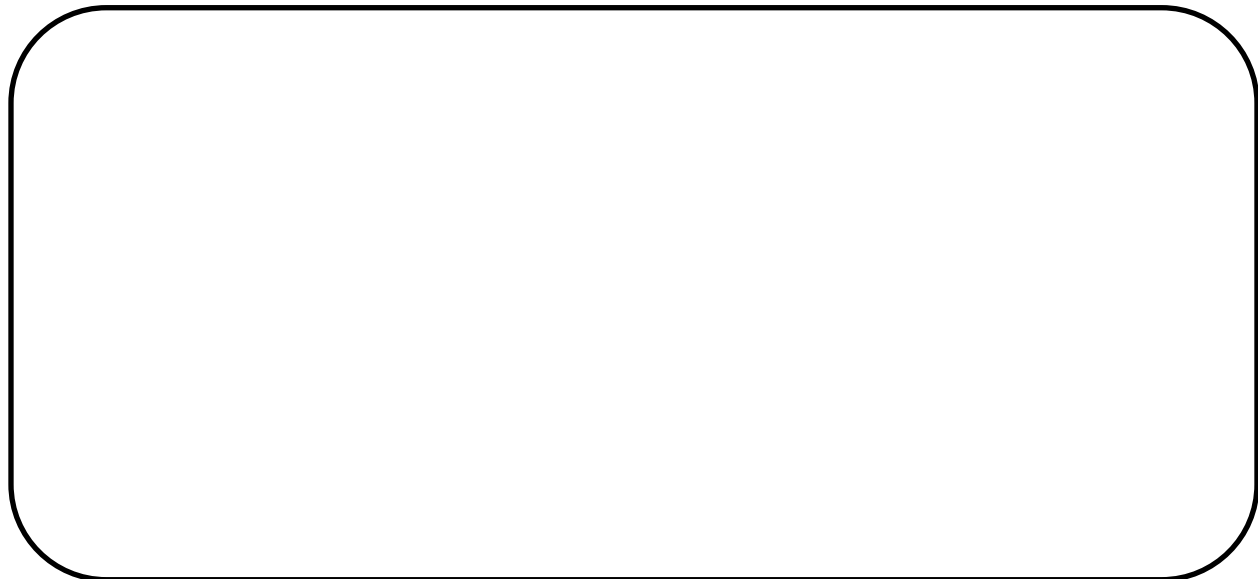


4. Show your procedures to your teacher for approval.

5. Once you have that approval, go ahead and conduct your tests. Record your observations and results below:



6. For each test you performed, discuss the limitations you faced in obtaining accurate data. How is the uncertainty of your measurements reflected in your results?



7. You have performed various tests and observations on your coin. Considering all of your data, what metal or metals do you think are present in your coin? Your written explanation should make reference to every observation and test you conducted.

#### Materials Properties for Reference

Material	Density (g/cm <sup>3</sup> )	Heat Capacity (J/g-C)	Magnetic?	Relative Hardness (higher = harder)
Aluminum	2.7	0.87	no	3
Copper	8.9	0.39	no	3
Gold	19.3	0.13	no	2.5
Iron	7.9	0.46	yes	4
Isopropyl Alcohol		2.68	no	
Lead	11.3	0.13	no	1.5
Nickel	8.9	0.46	yes	4
Plastic	0.6 to 3.9	1.1 to 2.0	no	1 - 2
Platinum	21.4	0.13	no	3.5
Silver	10.5	0.23	no	2.5
Steel	7.9	0.49	yes	4 - 7
Steel, stainless	8.0	0.50	slightly	4 - 7
Tin	7.3	0.24	no	1.5
Wood	0.2 to 1.3	2.0 to 2.5	no	
Water	1.0	4.19	no	
Zinc	7.1	0.38	no	2.5