

Analysis and Application

Using Forensic Science in the Science Classroom

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What Is Forensic Science?

forensic: *“relating to, used in, or connected with a court of laws”*

forensic science: *“the application of scientific knowledge to legal issues”*

my functional (classroom) definition:

“using science to solve a mystery”

Why Teach Forensic Science?

*It is the glory of God to conceal a matter;
to search out a matter is the glory of kings.*

Proverbs 25:2 (NIV)

Why Teach Forensic Science?

Forensic Science:

- Gives students skills in science, math, and logic
- Teaches students to think like scientists, logically and critically, and to draw conclusions based on facts
- Makes science fun, interesting, and applicable

How to Teach Forensic Science

- Offer forensic science as a stand-alone, semester-long course.
- Incorporate forensic science labs into your existing biology, chemistry, or physics course.

Incorporating Forensic Science

Biology

- Odontology
- Entomology
- Blood Typing
- DNA Fingerprinting

Incorporating Forensic Science

Chemistry

● Density

- Unknown metal
- Counterfeit penny

Incorporating Forensic Science

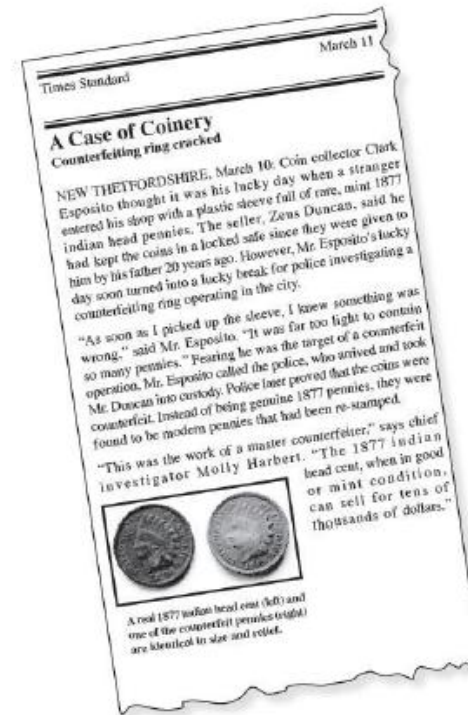
Introduction to the counterfeit penny lab

(newspaper image from Bonneau, *Forensics: Connecting Science Investigations with TI Data Collections Activities*)

Forensics Lab Counterfeit Coins

Name: _____

Date: _____



One tool that forensic scientists can use to determine the authenticity of a coin is to determine the composition - which metal(s) the coin is made from. One way to confirm or refute the composition is to find the coin's density. In this lab, you will use the characteristic property of density to determine whether coins are genuine or counterfeit.

Incorporating Forensic Science

Page 3 of the counterfeit penny lab

Below are tables showing the composition of pennies throughout American history and the densities of the metals used to mint pennies. Use the data in the charts to determine the density of 1877 pennies.

| Date | Penny Composition |
|--------------|---|
| 1793–1837 | Pure copper |
| 1837–1867 | 95% copper, 5% tin and zinc |
| 1857–1864 | 88% copper, 12% nickel |
| 1864–1942 | 95% copper, 5% tin and zinc |
| 1943 | Zinc-coated steel; pure copper in a few |
| 1944–1962 | 95% copper, 5% tin and zinc |
| 1962–1982 | 95% copper, 5% zinc |
| 1982–present | 97.5% zinc, 2.5% copper (copper-coated zinc) |

| Metal | Density (g/cm ³) |
|--------|---------------------------------|
| Copper | 8.92 |
| Nickel | 8.91 |
| Tin | 7.31 |
| Zinc | 7.14 |

http://www.usmint.gov/about_the_mint/fun_facts/index.cfm?flash=yes&action=fun_facts2

Hint: Use a weighted average. To determine the density of a modern penny:

$$97.5\% \text{ zinc} \times 7.14 \text{ g/cm}^3 + 2.5\% \text{ copper} \times 8.92 \text{ g/cm}^3$$

$$(.975 \times 7.14 \text{ g/cm}^3) + (.025 \times 8.92 \text{ g/cm}^3) = 7.18 \text{ g/cm}^3$$

The density of an 1877 penny would be: _____

Police took 10 of the suspect pennies and determined that their total mass was 24.97 g. Could these pennies have been genuine? Why or why not?

This lab was adapted from Bonneau, *Forensics: Connecting Science Investigations with TI Data Collections Activities*, ©2005, Texas Instruments.

(tables from usmint.gov)

Incorporating Forensic Science

Chemistry

- ⦿ Density
- ⦿ White Powder
 - Analyze multiple known powders
 - Compare properties of unknown powder
 - Flowchart to minimize consumption

Incorporating Forensic Science

Sample data table from white powder lab

| | Is it soluble? | Test the powder | | | Test the liquid | |
|--------------------|----------------|-----------------|---------|-------------------|-----------------|--------------|
| | | iodine | vinegar | FeCl ₃ | phenolph. | NaOH |
| starch | Y | blue-black | NR | NR | fizzes | NR |
| glucose | Y | NR | NR | NR | NR | NR |
| NaHCO ₃ | Y | NR | bubbles | bubbles/rust | pink | NR |
| MgSO ₄ | Y | NR | NR | NR | NR | white precip |
| acetaminophen | N | black | NR | green/black | white | NR |
| aspirin | N | blue-black | NR | tan/pink | white | NR |
| CaCO ₃ | N | NR | fizzes | bubbles/rust | NR | NR |
| CaSO ₄ | N | NR | NR | NR | NR | NR |

Incorporating Forensic Science

Chemistry

- ⦿ Density
- ⦿ White Powder
- ⦿ Chromatography and Beer's Law
 - Standard curve
 - Finding unknown graphically & algebraically

Incorporating Forensic Science

Chemistry

- Density
- White Powder
- Chromatography and Beer's Law
- Unknown Metal
 - density, reactivity, specific heat ...

Incorporating Forensic Science

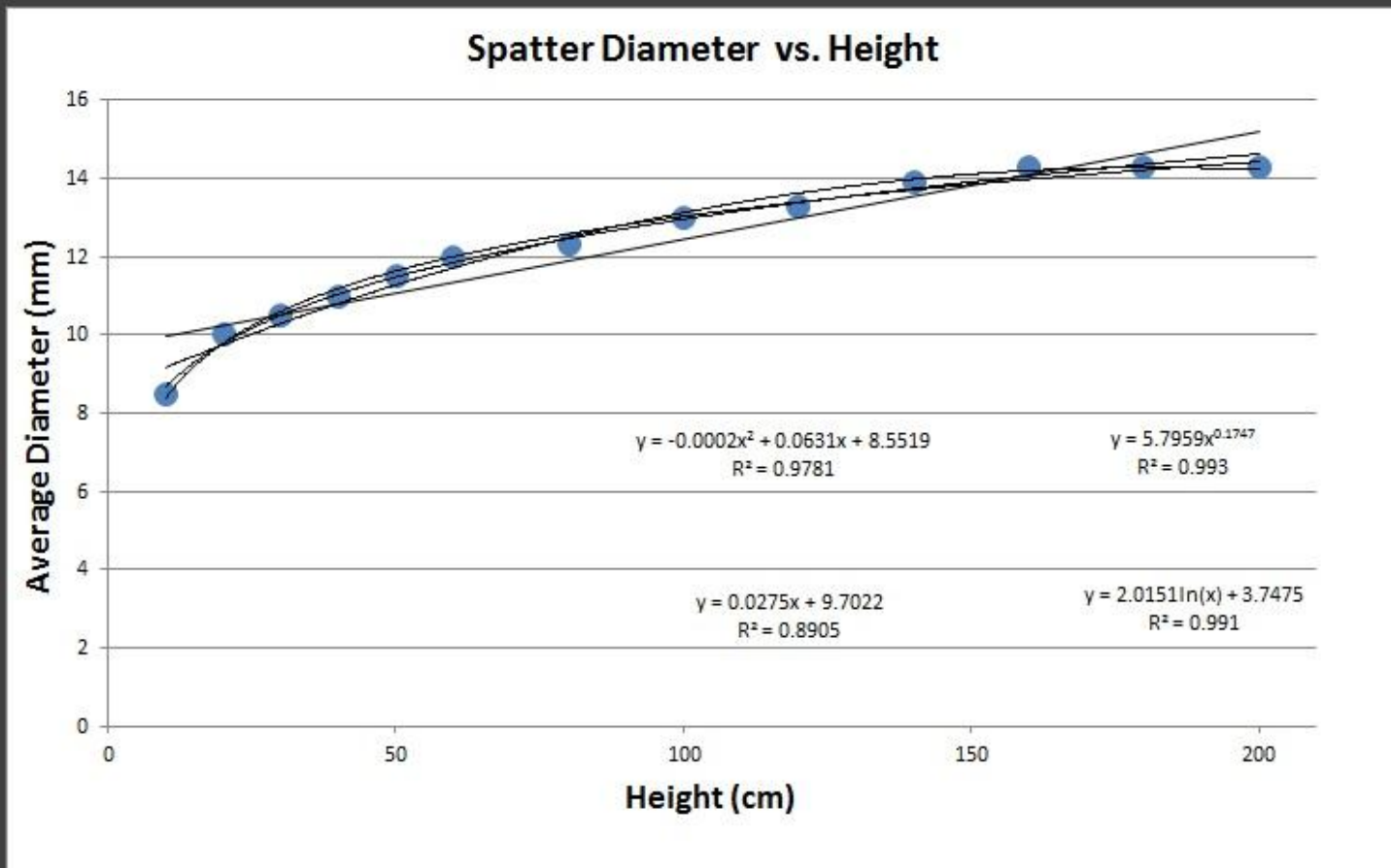
Physics

⦿ Blood Spatter

- Characteristics of blood drop
- Forces involved in dripping
- What determines size and shape
- Creating standard curve
- Regression analysis

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Sample graph from blood spatter lab



Incorporating Forensic Science

Sample graph from blood spatter lab

