

Analysis dr. curtis 01
24 2018 introduction:
copper is a



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Analysis of Copper in a

Penny

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Introduction:

Copper is a metal that is red

and orange in color and is the chemical element Cu which comes from the

Latin word cuprum.

Copper has a high heat and electric conductivity, which is why it is used in a lot of electrical equipment. Copper is a very versatile metal that can be combined with a lot of other different metals to become something else, like when you mix copper and tin to make bronze. It is also used in the making of US currency, like the US penny. Pennies used to be made of nearly pure copper before the year 1982; it was made of 95 percent copper and only 5 percent zinc. After the year 1982 to the present it was changed to 97.5 percent zinc and only 2.

5 percent copper. 1 To determine the mass percent of copper in a penny, two methods are used. The first method being atomic absorption spectroscopy, the second is ultraviolet-visible spectroscopy. Atomic absorption is a technique in which the absorption of light by free gaseous atoms or ions in a flame, furnace is used to measure concentration. 2 The sample needs to be a liquid that is sent through a plastic tube which is the hollow cathode then through a heat source. There are two different types of heat sources, flame and graphite furnace, which will reach 3000K these high temperatures are needed to turn the liquid into gaseous atoms. Then the gaseous atoms will go through the monochromator which is an optical device
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that will separate the samples wavelengths depending on what element you are trying to measure and will remove the unwanted elements that are in the sample.

Then the wavelengths will pass through the detector which will determine the mass percent of the element in the sample and it will show up on the data readout. In order for this to work the sample will need to be diluted so much that it will be at a parts per million level because at that level the precision of the instrument will be two percent. 3

Figure 1 . Box

diagram of an atomic absorption spectrometer Atomic spectroscopy is very useful in measuring trace amounts all the way up to major amounts of metal elements. To get the sample prepared you must make a dilution of 120 mL of 1 M $\text{Cu}(\text{H}_2\text{O})_6^{2+}$ in 1% HNO_3 .

Ultraviolet-Visible spectroscopy is the second method used to determine the mass percent of copper in a penny.

4 Figure 2.

Box diagram of Ultraviolet-Visible spectroscopy " Ultraviolet and visible (UV-Vis) absorption spectroscopy is the measurement of the attenuation (weakening of strength) of a beam of light after it passes through a sample or after reflection from a sample surface." 5 The light that is used allows the outer electrons to get excited enough to jump to a higher energy sublevel. The instrument has six important steps to go through; it first goes through a light source which can be either tungsten lamp for visible light or deuterium for UV light. Then there is the filter which extracts out any particles, then it goes through the monochromator, which is an optical device that will separate the samples wavelengths depending on what element you

are trying to measure and will remove the unwanted elements that are in the <https://assignbuster.com/analysis-dr-curtis-01242018-introduction-copper-is-a/>

sample. The wavelength that comes from the monochromator will go through the beamsplitter so that it can pass through the sample cuvette and the reference cuvette at the same time. Then it will go through the photodiode and it will then start the data processing and finally it will go to the data readout. The sample must be in a liquid form and it has to be free from particles, even the solvents used need to be pure because any particles that get into the instrument will cause the light to scatter and will give failed results.

The atomic absorption spectroscopy will be able to calculate the mass percent of copper in the penny better than the UV-vis spectroscopy because it is more sensitive and that entails it being more accurate. Using both methods will allow data comparison between both methods to see which is more accurate. Reference 1. What's a Penny Made Of?, By Live Science Staff | June 21, 2016 03: 55pm ET, <https://www.livescience.com/32401-whats-a-penny-made-of.html>

2. Exploring chemical analysis, Daniel C. Harris, 2009 W. H. Freeman and Company

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