1.1.3: Extensive and Intensive Properties

Note from Dr. B.

Do not worry about the "Explore More" section. The link does not work.

How much is twenty dollars really worth?

You agree to mow someone's lawn for twenty dollars (it's a fairly large yard). When they pay you, they give you a $20 bill. It doesn't matter whether the bill is brand new or old, dirty, and wrinkled—all of these bills have the same value of $20. If you want more $20 bills, you have to mow more lawns. You can't say, "this particular bill is actually worth more than $20." To have more money, you have to put in more work.

Extensive Properties

Some properties of matter depend on the size of the sample, while some do not. An **extensive** property is a property that depends on the amount of matter in a sample. The mass of an object is a measure of the amount of matter that an object contains. A small sample of a certain type of matter will have a small mass, while a larger sample will have a greater mass. Another extensive property is volume. The volume of an object is a measure of the space that is occupied by that object.

The figure below illustrates the extensive property of volume. The pitcher and glass both contain milk. The pitcher holds approximately two quarts and the glass will hold about 8 ounces of milk. The same milk is in each container. The only difference is the amount of milk contained in the glass and in the pitcher.

Figure 1.1.3.1: Milk pitcher and glass. (Credit: Zenon Niewada (Wikimedia: Pitcherman); Source: http://commons.wikimedia.org/wiki/File:Milk_Pitcher_With_Lid.jpg(opens in new window); License: Public Domain)

Intensive Properties

The electrical conductivity of a substance is a property that depends only on the type of substance. Silver, gold, and copper are excellent conductors of electricity, while glass and plastic are poor conductors. A larger or smaller piece of glass will not change this property. An **intensive** property is a property of matter that depends only on the type of matter in a sample and not on the amount. Other intensive properties include color, temperature, density, and solubility.

Figure 1.1.3.1: *Copper wire.* (Credit: User:Inductiveload/Wikimedia Commons; Source: http://commons.wikimedia.org/wiki/File:Tinned_Copper_Wire_anaglyph.jpg(opens in new window))

The copper wire shown in the picture below has a certain electrical conductivity. You could cut off the small end that sticks out, and it would have the same conductivity as the entire long roll of wire shown here. The conductivity is a property of the copper

metal itself, not of the length of the wire.

Summary

- An extensive property is a property that depends on the amount of matter in a sample.
- Mass and volume are examples of extensive properties.
- An intensive property is a property of matter that depends only on the type of matter in a sample and not on the amount.
- Color, temperature, and solubility are examples of intensive properties.

Review

1. Define extensive property.
2. Give two examples of extensive properties.
3. Define intensive property.
4. Give two examples of intensive properties.

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