

## Unit 2: Chemistry

### Chapter 4 Characteristics And Properties Of Matter

#### 4.2 Measuring Matter Student Notes (p.111-121)

##### Learning Outcomes

- How physical changes of matter are different from chemical changes of matter
- How to measure mass and volume and calculate density

##### Why Is It Important

- Describing and measuring matter enable you to communicate your observations to others

##### Skills you will use in this chapter

- Measure mass and volume

All matter- large or small, heavy or light, liquid, solid, or gas has two things in common: mass and volume.

The **mass** of an object is the quantity of matter that makes up the object.

The **volume** of an object is the quantity of space that the object takes up.

The property of matter that is related to mass and volume is **density**.

If you hold a solid piece of lead or iron in your hand, it feels heavy for its size. If you hold the same size piece of balsa wood or plastic, it feels light for its size.

The property of an object that causes this effect is called *density*.

The density of an object depends on its mass and its volume.

The mass is the amount of matter in the object.

The volume is the amount of space that the object takes up in three dimensions.

##### Measuring Mass

A lion is made up of a lot of matter - it has a large mass.

A mouse is made up of much less matter than a lion is. A mouse has a smaller mass than a lion does.

How can you describe mass using numbers?

- You usually describe large masses with kilograms
- You usually describe small masses with grams

People usually measure mass using a device called a **balance**

##### Practice Measuring Mass Activity 4-C (p.112)

##### The Volume of Matter

Volume is a measure of the amount of space that a sample of matter takes up.

All matter - regardless of its state - has volume.

You measure the **volume of a solid** in cubic units (cubic meters or cubic centimeters)

Ex. A refrigerator has a volume of  $1 \text{ m}^3$

A sugar cube has a volume of  $1 \text{ cm}^3$

You usually measure the **volume of a liquid or gas** in litres or millilitres.

Ex. Buy milk in a 1L carton

A common medicine dropper holds about 1 mL of liquid

The cubic units for measuring the volumes of solids related to the units for measuring the volumes of liquids and gases

$1 \text{ cm}^3$  is the same volume as 1 mL

$1 \text{ cm}^3 = 1 \text{ mL}$

### **Measuring Volume**

You can calculate the volume of any cube or rectangular solid by using this formula:

$$V = L \times W \times H$$

(Volume = length x width x height)

V is volume

L is length

W is width

H is height

You can take measurements and use a formula to calculate the volume of any regular solid, such as a cube or cardboard box.

How do you measure the volume of a solid that has an irregular shape, like a stapler or rock?

What happens to the water level when you get into the bathtub?

**Displacement** involves measuring how much water a solid object displaces (pushes aside) when it is submerged in water.

### **Practice Measuring Volume 4-D (p. 114)**

### **Density: A Property That Links Mass and Volume**

The quantity of mass in a certain volume of a material is called density.

To find the density of a substance, you need to measure the mass and the volume of a sample of the substance.

### **Building a Density Tower 4-E (p.117)**

A mathematical equation for density is: Density = mass/volume or  $D = m/v$ .

(Density = Mass divided by volume)

If something has a large mass compared to its volume, it has a high density.

For example, a set of weights -which can be small but heavy.

But if an object has a small mass compared to its volume it has a lower density. This is like an apple or a piece of wood, which can seem light for its size.

***The density of a substance is the same no matter what the size of the sample.***

Measuring Matter WS

More Dense or Less Dense WS

Check Your Understanding P.121