

## CHAPTER 3: MATTER

### 3.1 Matter Has Mass And Occupies Space

#### Things Have Mass And Occupy Space.

1. Everything around us has mass and occupies space.
2. The following activities will help you to see that things such as books, air, water, soil and living things have mass and occupy space.  
Examples :
  - i. Your school bag becomes heavier and heavier as you put your school books into it.
  - ii. A balloon filled with air is heavier than a similar balloon that has been punctured. **PMR 08**
  - iii. A balloon gets bigger as you blow air into it.
  - iv. A glass becomes heavier and heavier as you pour water into it.
  - v. A lift can take in only a number of people at a time.

#### What Is Matter.

1. Matter is anything that has mass and occupies space.
2. We have seen earlier that everything around us has mass and occupies space.
3. Therefore, we can say that everything around us is matter. There are included living things and non-living things on the Earth.
4. Living things, for example, human beings, birds and insects are matter.
5. Non-living things, for example, air, water, soil, rocks and books are also matter.
6. However, some things are not matter. For example, light, sound and heat are not matter because they do not have occupy space.

### **3.2 The Three States Of Matter. PMR 06**

#### **What Is Matter Made Up Of ?**

1. Matter is made up of **very small particles**.
2. These particles are so small that they **cannot be seen even with a microscope**.
3. These particles are the **basic units of matter**.
4. There are spaces between the particles because they are discrete.
5. The particles of matter can move.

Example : When you break a piece of chalk, you will find that is actually made up of fine powder. You can keep breaking up the chalk into smaller and smaller parts. You will get very small and discrete particles and cannot be seen even using microscope.

#### **The Three States Of Matter**

1. Matter can exist in three different states :
  - i. Solid - rice, sugar, salt, coins, stones, sand and steel.
  - ii. Liquids - cooking oil, kerosene, lubricant and alcohol.
  - iii. Gases - air, cooking gas and water vapour.

#### **The Arrangement And The Movement Of Particles In The Three States Of Matter. PMR 03, 05**

1. Solids -
  - The particles are arranged close together in a fixed, regular pattern.
  - the particles cannot move freely.
  - The particles can only vibrate about their fixed positions.

Figure 3.7 - Textbook Pg. 8

2. Liquids - The particles are still quite close together but not as close as those in a solid.

- They are not arranged in a regular pattern.
- The particles can glide freely over one another.

Figure 3.8

3. Gases
- The particles are very far apart from one another.
  - The particles are not arranged in any pattern.
  - The particles can move freely at random.

Figure 3.9

4. Table below shows the comparison between three states of matter :

Characteristics	Solids	Liquids	Gases
Model	Page 8 and 9		
Arrangement Of Particles	<ul style="list-style-type: none"> <li>- fixed, regular pattern.</li> <li>- Close to one another.</li> </ul>	<ul style="list-style-type: none"> <li>- not arranged in a regular pattern.</li> <li>- Still close to one another but not as close as that in solid.</li> </ul>	<ul style="list-style-type: none"> <li>- do not have any arrangement at all.</li> <li>- Very far apart from each other.</li> </ul>
Movement of Particle.	<ul style="list-style-type: none"> <li>- cannot move freely.</li> <li>- Can only vibrate about their fixed positions.</li> </ul>	<ul style="list-style-type: none"> <li>- can move about randomly by gliding over one another.</li> </ul>	<ul style="list-style-type: none"> <li>- move freely at random at high speed.</li> </ul>
Space Between particles.	very small.	small.	very big.
Force Of Attraction Between Particles.	very strong.	quite strong.	very weak.
Energy content	Low	Medium	High

### 3.3 The Concept Of Density. **PMR 03, 06, 07, 08**

1. The **density** of a substance is defined as the **quantity of mass** contained in the substance for a **unit volume**.
2. We can easily find the density of a substance if we know the **mass** and the **volume** of the substance.
3. the density of substance depends on:
  - a. mass : The bigger its mass, the bigger its density is
  - b. volume : the bigger its volume, the smaller its density is.
4. Density ( $\text{g}/\text{cm}^3$ ) = Mass ( $\text{g}$ ) / Volume ( $\text{cm}^3$ )
5.  $D = M/V$
6.  $M = DV$
7.  $V = M/D$
8. Unit of density is  $\text{kg}/\text{m}$  or  $\text{g}/\text{cm}$ .
- 9.
10. Different substances have different densities. Here are the densities of some common substances. **PMR 05, 06, 07**

Pg 10 ( Textbook ).
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11. Example I to IV - Pg. 13 ( Textbook )

#### Why do some objects and liquids float?

1. A substance is able to float or sink in a liquid depending on its density.
2. A less dense substance floats in a denser liquid whereas a denser substance sinks in a less dense liquid.

Example :

Ice floats in water because it is less dense than water.

A gold sinks in mercury because it is denser than mercury.

## The Use Of Properties Of Matter In Everyday Life.

1. Man can apply different states of matter and the concept of density in everyday life.
2. Man can make use of his knowledge of the application of the different states of matter to enable him to store and transport gases and liquids. Some of examples are
  - a. some gases can be compressed into liquid form, thus reducing its volume and allowing it to be transported easily.
3. Man can also make use of concept of density in everyday life. Some example are :
  - a. Buoy.  
The buoy is filled with air and has a lower density than water.
  - b. Raft.  
The raft has a lower density than water.
  - c. Logs.  
The logs have a lower density than water.