WHAT IS CHEMISTRY?

- **Chemistry** *is a science that* ***studies*** *the* ***properties of substances*** *and how substances* ***react with each other****.*
- Chemistry is the **science** concerned with the composition, structure, and properties of **matter**, as well as the changes it undergoes during **chemical reactions**.
- Chemistry has the **task** of investigating the materials of which our universe is made.
- Chemistry **investigates** chemical changes, conditions under which chemical changes occur.
- Chemistry also **deals with** the way in which similar changes can be brought about in laboratory and on a large scale in industries.

Who uses chemistry?

- Many people use chemistry as part of their work.
- ***Cooks*** use chemistry all the time. They may not have studied chemistry like you, but they learn by experience how to control the changes that happen when food is cooked.
- ***Doctors*** use chemistry, because everything that goes on in the human body involves chemistry
- ***Engineers*** use chemistry, when they decide what materials to make things from.

Where do the chemists work?

- People who have trained as **chemists** work in **hospital laboratories**, in breweries, in oil refineries, in food laboratories and in factories making everything from plastics to poppadums.
- Chemists do a **particularly important job** in **protecting the environment from** the effects of **human activities**

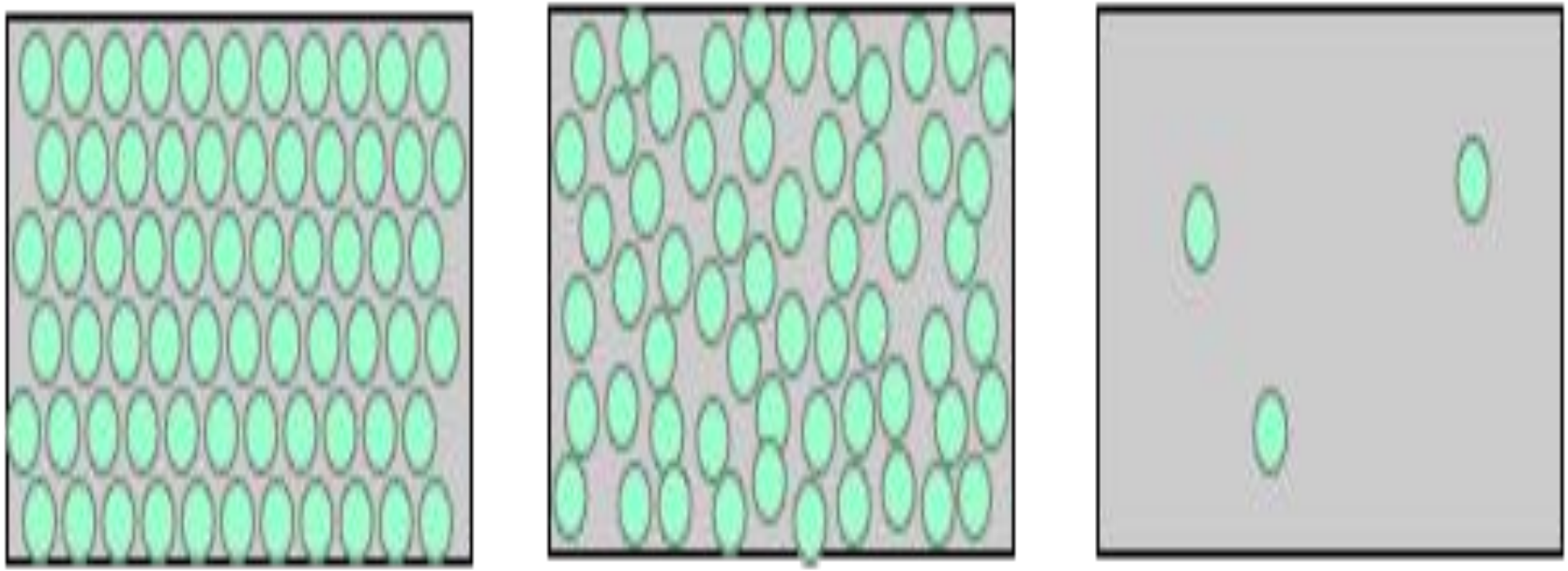
MATTER and states of matter

- **Matter** is anything that has mass and takes up a space. Matter can be recognized by its properties of mass and volume.

States of matter

- Matter exists in three different states: ***solid, liquid and gas.***
- If the whole space is considered we should talk about ***a fourth state – plasma***. Almost all objects found in the space consist of plasma. At extremely high temperatures, all matters can not confine at liquid, solid, and gaseous states and ***dissociate into their ions and atoms***.
- Flames, magma layer, sparkles passing in higher-voltage cables, stars and the sun can be given as example of plasma.

States of matter



solid

ordered arrangement,
molecules in contact

liquid

some disorder,
molecules in contact

gas

complete disorder,
molecules not in contact

‘substances’

- Scientist also use the word **‘substances’**. This means a particular type of matter, which you can put a name to.
- Salt is a substance, and so is water.
- Light is not a substance, because it has no mass and volume and it is not matter.

ELEMENTS

- **An element** is one of a group of fundamental substances that cannot be broken down into simpler substances.
- All of the elements have **names** but **each element has been** also **assigned its own unique symbols**, which we will find useful for writing **chemical formulas and chemical equations**.
- The names of chemical elements change a little from one language to another, but symbols do not.
- Until the 16th century some elements were named as follow.

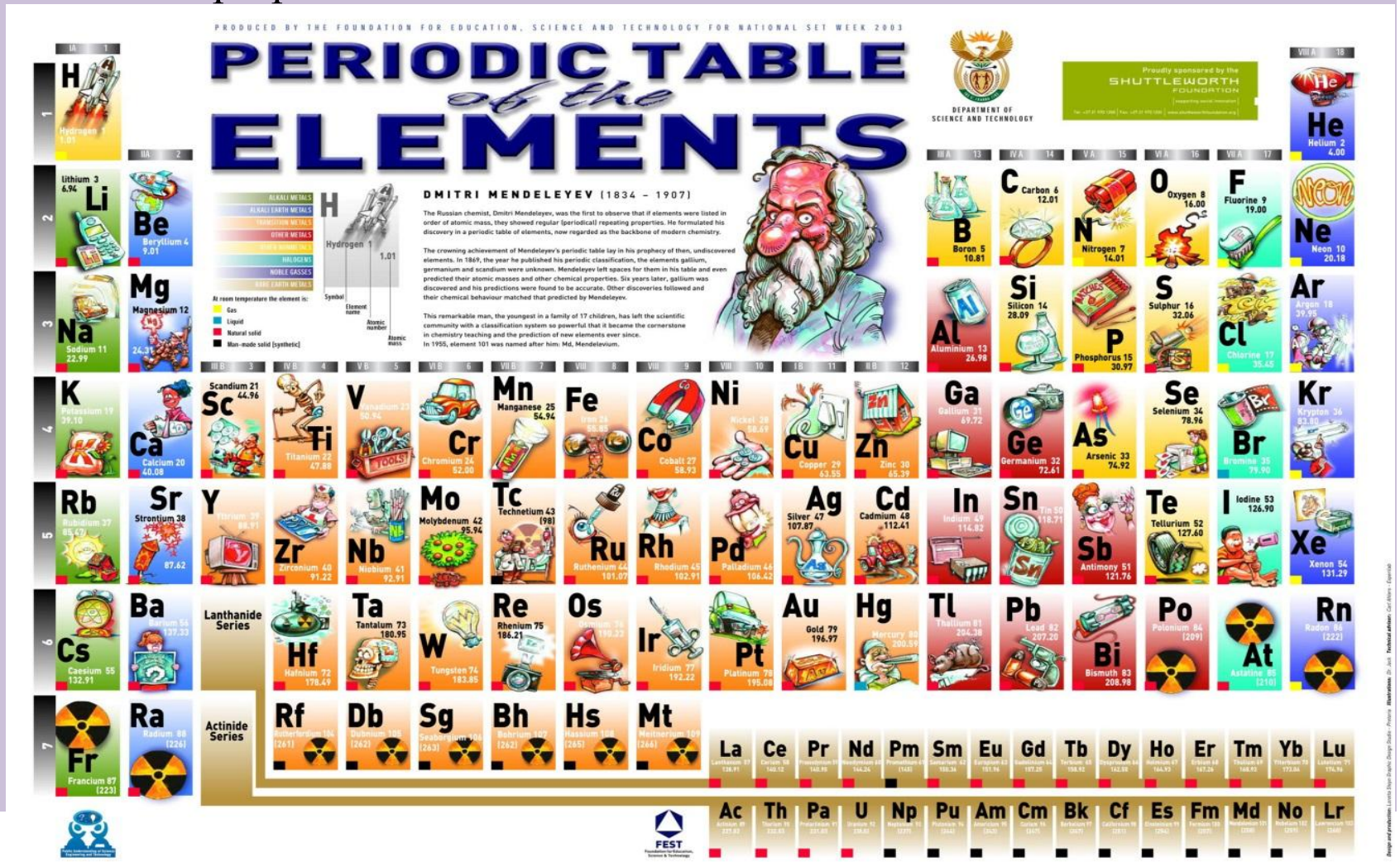
Element	**Name**
Gold	Sun
Copper	Venus
Tin	Jupiter
Mercury	Mercury
Silver	Moon
Iron	Mars
Lead	Saturn

Symbolic representations

- Later on symbols were used because of the difficulty for finding names to excessive number of **newly found elements.**
- **By the beginning of the nineteenth century**, there were about **26** known elements, but by the beginning of the **twentieth century**, there were **more than 81**. As more elements were discovered, **the need for symbolic representations for** these elements became **more evident**.
- All symbols for elements are placed on a special table called **the periodic table**.
- Today, **116** elements are known; **92** of which are called natural elements

THE MODERN PERIODIC TABLE

- The modern periodic table appeared as a function of the physical and chemical properties of elements.



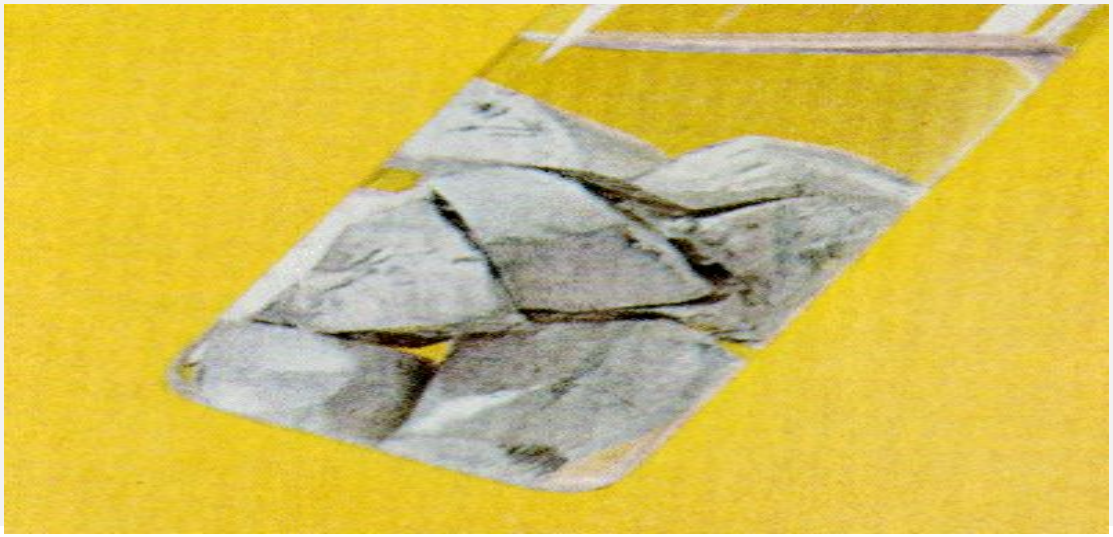
USAGE OF SOME ELEMENTS

Hydrogen:

- A rocket fuel
- Production of hydrogen bomb
- Being the lightest of all gases hydrogen was used to inflate ballons, but its high inflammability led to a number of explosions and its eventual replacement with helium
- Refining of the petroleum
- Reduction of oxide ores to metals

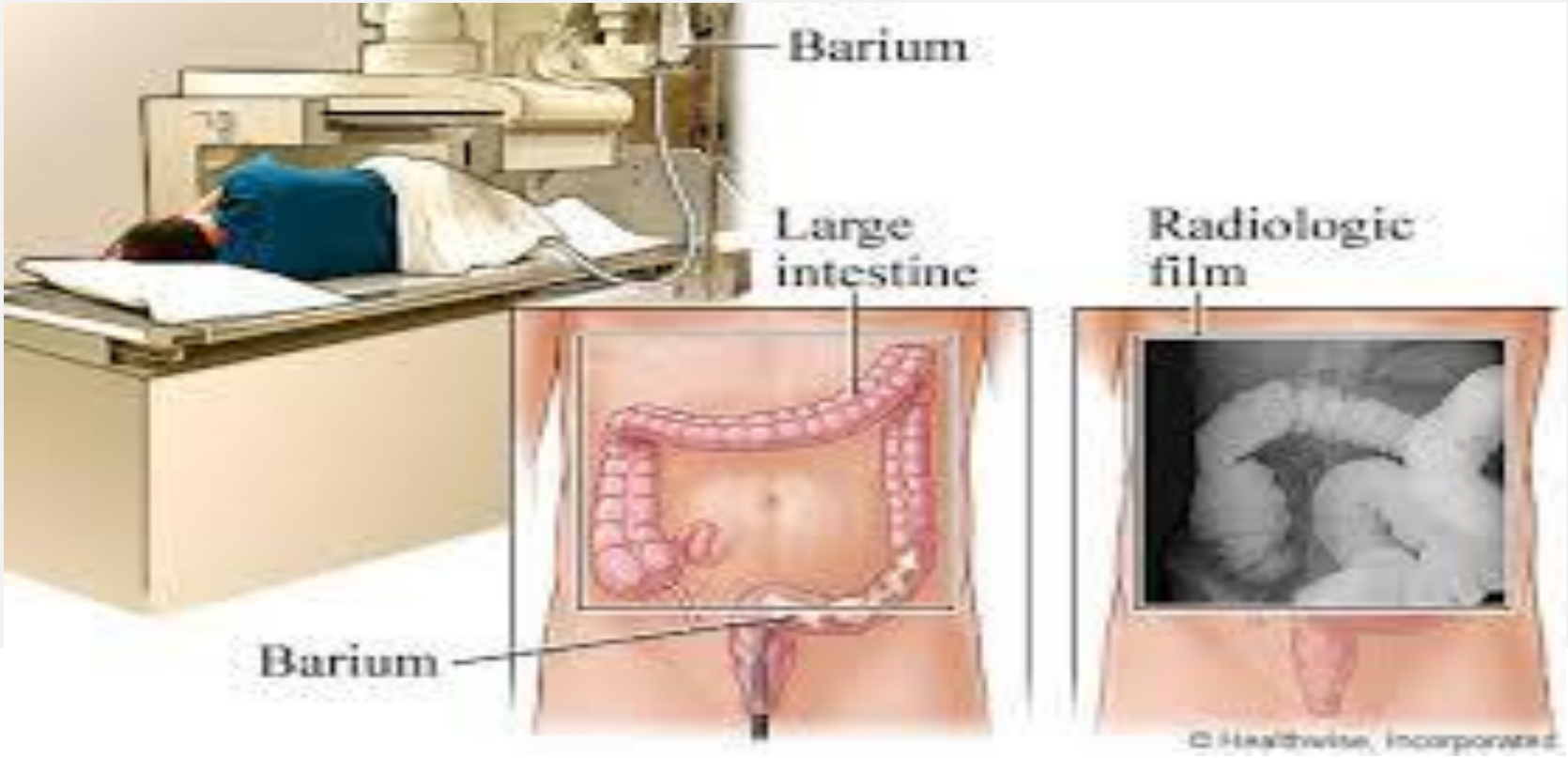
Sodium:

- Production of electricity in nuclear reactors by transferring excess heat to the vapor turbines
- Its salt are used in medical industry
- Production of soap, baking soda, glass and pigment



Barium:

- Gas absorbent in vacuum tubes
- Green light in fireworks
- $BaSO_4$ is used to take the photos of stomach and intestine



Physical and chemical changes

- When we look around, in the world we live, we see some **changes**. For instance, **evaporation of water**, rain and snow, **spoil of a fruit**, drying up of paint on the wall, **solidification** of cement, fires, **dissolving** of sugar in tea and **rusting** iron.
- There are some events where the changes occur in the **chemical structure**, but in some events matter changes only physically. Therefore, **changes in matter may be considered as physical and chemical changes**.

Physical and chemical changes

chemical changes

- Changes in the molecular structure of substances are called **chemical changes**.
- baking of cake
- rusting of iron
- Another example in daily life is the **souring** of milk. It spoils at hot places after a while. That is, there are **some changes in its chemical properties**. In this event, bonds that hold the molecules and atoms are broken down, whereas, some **new bonds** form at the same time. **This means that new substances with new properties form.**

physical changes

- **Evaporation** of water, **melting** ice, **dissolving** of sugar in water, **powdering** marble, breaking of glass are not chemical changes and such events **do not include changes in chemical properties** but some of their physical properties change.
- Those kinds of changes are **physical changes**

Some more examples

evaporation of water - physical change

cooking of egg – chemical change

dividing of apple – physical change

frying of potato – chemical change

pouring of milk – physical change

making of yogurt – chemical change