EXPLORING SCIENCE

2nd edition

For the Junior Cycle

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Unit 3 Chemical World
Chapter 14 Observing change

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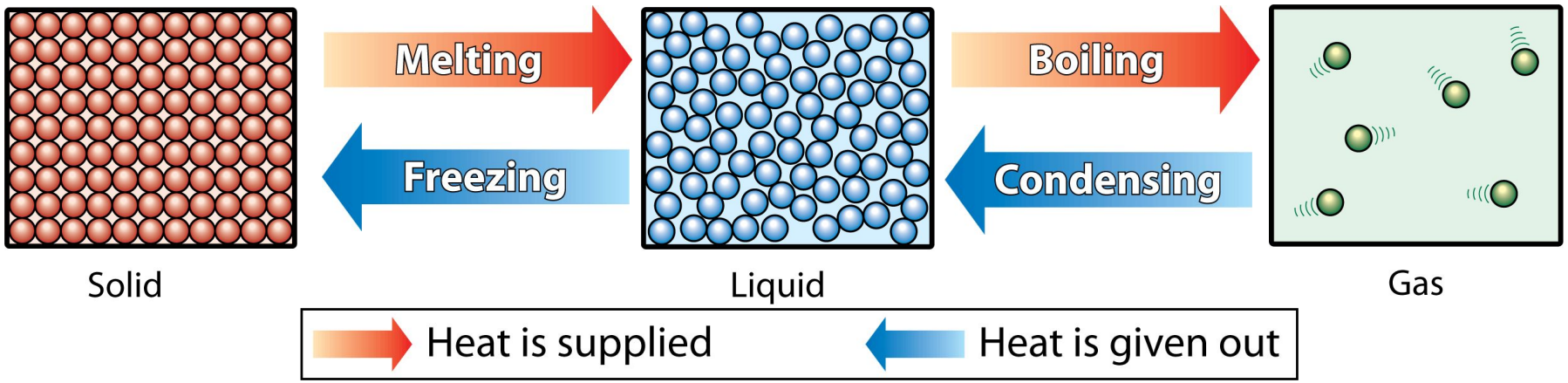
In science there are many changes, but can they always be reversed?

Physical change

Our study of chemistry leads us to a better understanding of our world and the processes by which materials can change and be changed. We know from chapter 13 that matter exists in three states (see below for a recap).



The changes shown in Figure 14.1 are reversible and no new substance is formed; there is just a change of state. This is called a **physical change**. **It describes a situation in which there is no change in particles, just the particle arrangement and energy**.

In science there are many changes, but can they always be reversed?

Chemical change

A burning match is an example of a **chemical change**, **in which a chemical reaction takes place and a new substance is formed. During a chemical change energy may be released or absorbed. This means chemical changes are usually very difficult to reverse.**

Chemical reactions

Many useful materials are produced from chemical changes (also known as chemical reactions). These include plastics, which are made from reactions with oil.

The chemicals that react together are called reactants and the substances formed are called products. Chemical reactions are represented using equations (word equations and chemical equations).

Word equation: **carbon + oxygen → carbon dioxide**

reactants **product**

Chemical equation: $C + O_2 \rightarrow CO_2$

Observing change

During a chemical reaction the atoms rearrange to form a new substance. There are some signs that indicate this has occurred:

- Colour changes
- Temperature changes
- Light is emitted
- Bubbles of gas are produced.

A chemical reaction takes place when a firework is lit

Conservation of mass

We know that matter can be changed from one form into another, but during physical and chemical changes, is there a change in the overall mass of the matter, or does it remain constant?

Law of conservation of mass

Antoine Lavoisier, a French chemist in the 18th century, discovered the law of the conservation of mass. He discovered that the mass of a substance cannot be created or destroyed, so during a physical and chemical change there is no change in the overall mass.

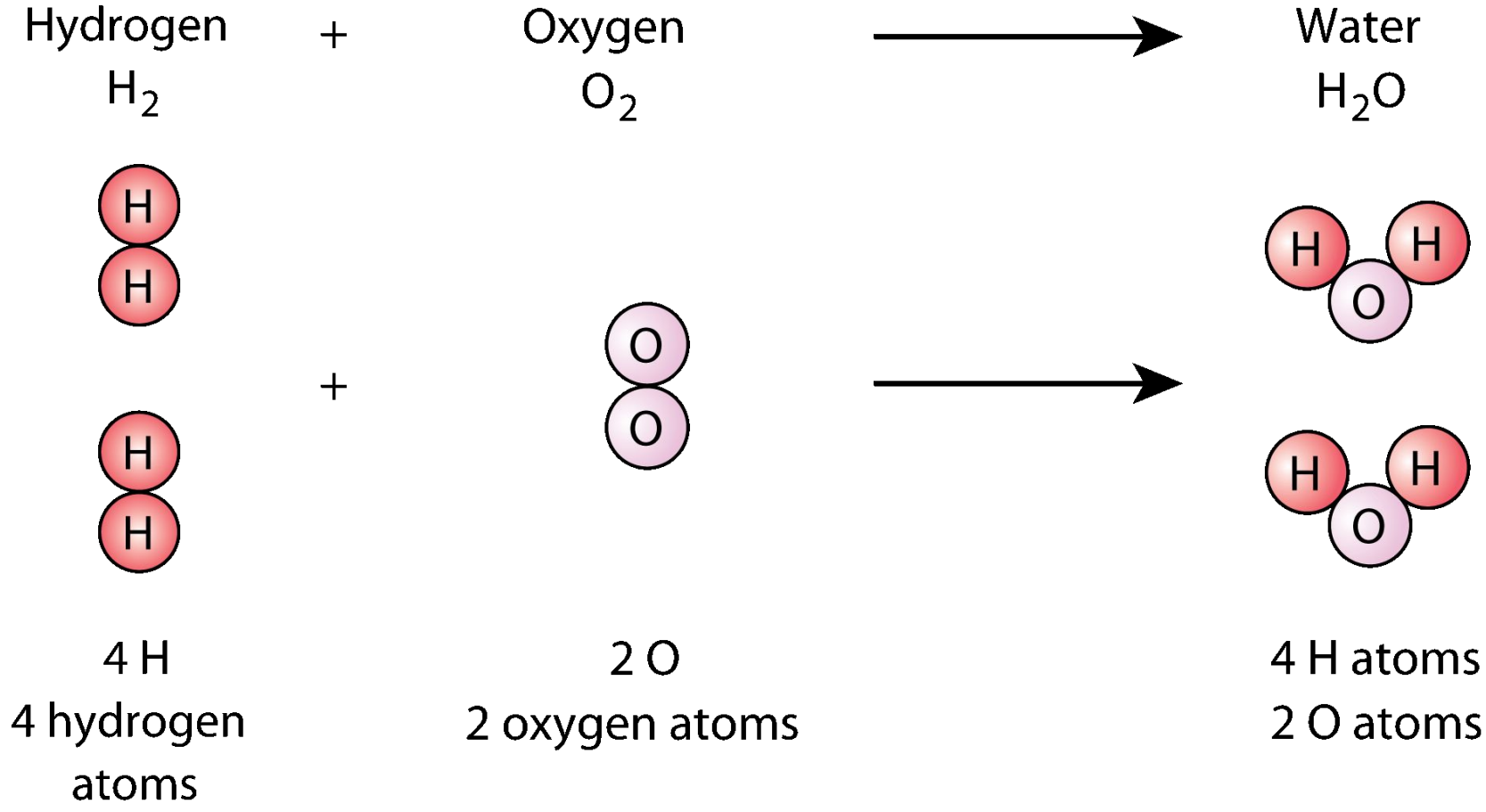
total mass of reactants = total mass of products

carbon + oxygen → carbon dioxide
2g 2g 4g
mass of reactants = 4 g mass of products = 4 g

Antoine Lavoisier

Particle model diagrams

A particle model diagram shows how particles (atoms) rearrange to form a new substance during a chemical reaction.



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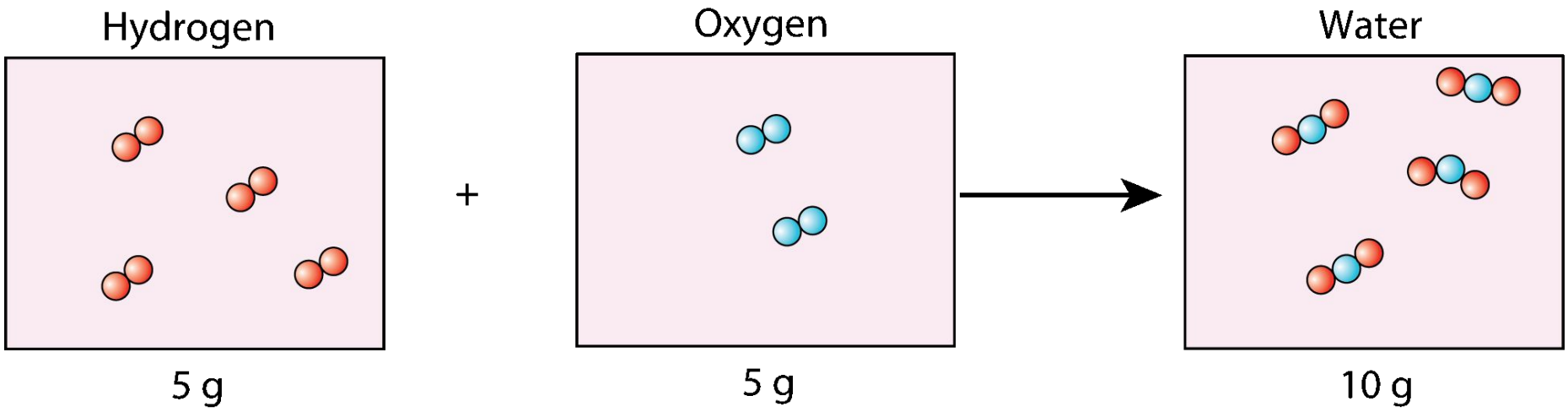

The reactants and the products have the same number of each type of atom, so this explains why there is no change in overall mass.

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