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SCIENTISTS GUIDING THE SCIENCE OF CHEMISTRY

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ABSTRACT: Chemistry is one of the oldest in science. It is a branch of basic science that examines the characteristics of all substances in the universe, interactions with each other and the changes that occur after interactions. It's one of the first natural sciences. Chemical science is a multidisciplinary science. Physics, biology, astronomy, archaeology, pharmacy and medicine are some of them.Among basic sciences, chemistry or physics is the closestinteraction. When chemistry examines the interaction of matter. its properties and its change, physics also deals with the relationship between matter and energy and explains the relationship of substances with the law. It is very difficult to distinguish between these two branches of science. Chemical science It consists of seven disciplines: organic chemistry, inorganic chemistry, analytical chemistry, physics, biochemistry and nuclear chemistry, polymer chemistry. Although chemistry is a branch of science that has completed its development, there are many unanswered questions and unexplained events. Modern chemistry today is the result of thousands of years of accumulation. For thousands of years, mankind has managed to turn natural materials into useful products. The emergence of Chemistry, a field of study based on scientific principles, led to tremendous advances in technology and industry, despite the fact that it reached the second half of the eighteenth century. This thesis is a literary study that includes the mini-biography of important scientists who played a role in the emergence and development of chemical science from antiquity to the present day, as well as the discoveries that guide science.
Keywords: Chemistry, Chemists, Science,Pharmacy,Alchemy

1. INTRODUCTION

The word chemistry is used in Turkish in terms of metaphorically rare, very valuable thing, superior characteristics. Chemistry is a subdisciplinary of science that deals with the study of matter and the substances that make it up. It also deals with the properties of these substances and the reactions they undergo to create new substances. Chemistry primarily focuses on atoms, ions and molecules that take turns forming elements and compounds. These chemical species tend to interact with each other through chemical bonds. It is important to note that the interactions between matter and energy are also examined in the field of chemistry. Chemistry, unlike other sciences, was originally born of delusion and superstition, and at its beginning it was precisely at the level of magic and astrology. The benefit and importance of chemistry began to attract the world's attention when he was able to free himself from these delusions, despite the contempt and contempt of the enlightened part of humanity. It attracted the attention of the most important and active scientists in every country and quickly moved towards perfection. Its most important feature is its universal acceptance. Today, it has become a necessary part of education. Chemistry contributed to the progress of society as much as the sum of all other sciences, increased the comforts and conveniences of life, and increased the power and resources of humanity. In this study, we will touch on the life of some scientists who have guided the science of chemistry and their contributions to the science of chemistry (Thomson 2021).

1.1. Pre-Chemistry Alchemy

Alchemy can be defined as an art rather than a science. Alchemy can also be considered as a pre-science form of chemistry. Alchemy; Astrology, astronomy, mythology, magic, religion and many other countries were associated with a wide range of practical laboratory applications to mysticism. There were two important reasons that drove alchemists to investigate:

1. Getting rich by turning metals such as lead and zinc into gold, a valuable metal.
2. To find the potion of life that will provide immortality.

As a result of the studies carried out by alchemists through trial and error, they found and developed tools such as furnaces, distillation apparatus and water baths, and laboratory techniques such as distillation, filtration, sublimation and crystallization, which were later used by chemists.Looking at today, it seems that there are more than one problem in alchemy. There was no systematic nomenclature for the compounds found. The language used was esoteric and vague. This caused it to be understood differently from person to person. The language used in alchemy developed a mysterious technical vocabulary. This language is largely incomprehensible to us today (Brock 1992).But Alchemy laid the foundations of chemistry and led to the science of chemistry.

1.2.Famous Alchemists

1.2.1. Thales (624/623 BC – 548/545 BC): Thales was born in Milet,Ionia, in 624-625 B.C. According to Aristotle,he was the first natural philosopher and cosmologist. Thales has also done many studies onmathematics, philosophy and alchemy. These include various geometric discoveries, measurement, study of solstices and measurement of astronomical seasons. In his work on alchemy, he argued that the main element of the substance is water. According to Thales, water is at the heart of everything, and the soil is standing above the water.Thales, who made such inferences about water, stated that the water, which alchemists did not yet know about, could exist in solid and gaseous form as well as liquid form. The primitive importance of water isalso mentioned in the egyptian and Babylonian myths of ancient times. Since Thales leaves no written works, it is impossible to know how historically the achievements attributed to him are. The name Thalesremained in the memory as a sign of the beginning of Greek geometry, astronom, eastern science and myth**.** Thales died in his 70s in 548-545 B.C. (Kahn 2016).

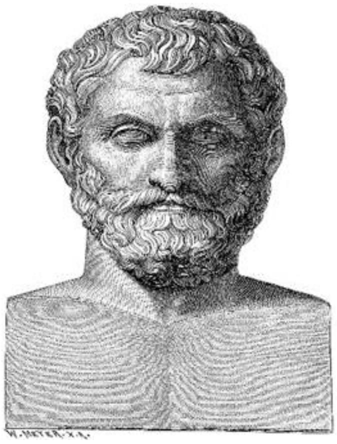

Figure 1. Thales

1.2.2. Anaximenes (585-525 BC): Anaximenes was born in the Greek city of Miletos in 585 B.C.Anaximenes is a natural philosopher and alchemist. According to Anaximenes, the main ingredient that Thalesaccepts as water is actually air. Anaximenes argued that air is much more essential to living things on Earth than water, and that air occupies more space in the world than water, and said that the main ingredient is air for reasons such as this. Anaximenes died in 582 B.C. at the Olympics in Greece at the age of 59-60 (Burnet 1908).

Figure 2. Anaximenes

1.2.3.Empedokles(495-435 BC): Empedokles was born in Akragas, Sicily, in 495 B.C.He was actively involvedin political life in Akragasalongside people who were indemocratic thought. He was a philosopher, poet and physician. Plato's workincludes philosophical and scientific theories of Empedokles. These theories are very important for Aristotle'swork onbiology and physics and for Greek commentators. Diogenes Laertios devoted part of his book The Lives of Famous Philosophers to him and his work. The vast majority ofEmpedokles' work has survived inchapters found in the work of Diogenes Laertios and other ancient authors.Empedokles is the first alchemist to think and reveal these 4 main substances in the unitedstates by adding soil matter to substances such as air, water and fire, which nature thinkers who lived in the periods before them saw as the main substance. In Empedokles's opinion, these 4 basic substances combine or separate with the power of love and hatred. In fact, according to Empedokles, love and hate are also fundamental elementsthat constitute matter. Heused love and hatred to explain the changes between these 4 articles. Another important idea of empedokles is the idea that "A substance cannot be made of nothing, it cannot be destroyed while it exists." Empedokles is one of the most important alchemists in the ancient world. Empedokles died in 435 B.C. at the age of 59-60. Although there are various rumors about the place and shape of death, it is not fully known (See 2005).

Figure 3. Empedokles

1.2.4.Aristotle (384-322 BC): Since interest in the life story of Aristotle really awakened only a few generations after his death, the relevant resources are extremely weak. Aristotlescame to prom in 384 B.C. in the town of Stageira on the Halkidike peninsula in northern Greece. When he was 17, he went to Athens. Anew democratic system was restored in Athens after its defeat in the Peloponnesian War againstSparta in 403B.C. In this system, radical democracy was replaced by a moderate popular administration. (Schmitz 200).

Aristotle is the foremost thinker of his age with his work, ideas and thoughts. He is a philosopher who contributed greatly to the formation of Western philosophy. At the heart of many philosophical ideas today are the ideas of Aristotles. Aristotle also worked in the field of alchemy. According to the theory put forward by Aristotle, there are 4 elements in nature: fire, water, air and soil. Aristotle died in 322 B.C. at the age of 61-62 (Shields 2012).

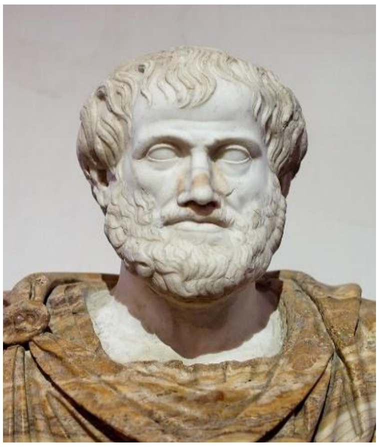

Figure 4. Aristotle

1.2.5. Ebu Musa Cabir Bin Hayyan (721-815): Abu Musa Cabir Bin Hayyan was a scientist who was born in 721 to a pharmacist father and continued his profession. Although Câbir's work spanned fields of science such as astronomy, mathematics, medicine and philosophy, his main interest was chemistry. E. J. Holmyard was the first to recognize its importance in the history of chemistry and to realize that it had made chemistry a systematic and experimental science. E. J. Holmyardconsiders that Câbir has an important place not only asa chemistbut alsoas a medical examiner, philosopher and astronomy scholar in the history of science. E. O. Lippmann, on the other hand, thinks that Câbir's place in the history of chemistry is the same as that of the founders of modern chemistry such as Boyle, Priestley and Lavoisier. Câbir applied this method in all his studies. His writings, "We mentioned not what we heard in this book, what we were told or what we read, but the characteristics of what we observed after experiencing it", show how much he attaches importanceto the experimental method. Therefore,the majority of medieval chemists were influenced by Câbir. Alchemists such as Abu Bakr er-Razi and IbnSinareferred to him as master in his works. Roger Bacon referredto himas "the master of masters." Abu Musa Cabir Bin Hayyan died in 815 at the age of 93-94 (Kaya 1992).

Figure 5. Abu Musa Cabir Bin Hayyan

1.2.6. Abu Bakr Er Razi (865-925): Abu Bakr Er Razi was born in Rey in 865. He is an alchemist who has done important work in the fields of alchemy, music and philosophy. AbuBakr Er Razi has approximately 200 books in different fields. He is the first alchemist to find alcohol and kettle, and also to indicate that smallpox is different from measles. Abu Bakr Er Razi'dir, who found ethyl alcohol. Ebu Bekir ErRazi's work in thefield of chemistryis important. It is knownthat Razi, who believes that valuable materials can be obtained from them by putting worthless mines into some processes, benefited from the work of Cabirb. Hayyanonthis subject andcalled him our master. Abu Bakr Er Razi divided the chemicals into three classes: those derived from mines, animals and plants. It identified their duties in chemical joining and alloy by dividing the substances consisting of their derivatives into lower classes.Meanwhile, it is consideredto have changed chemistry from theory to practice due to its lack of chemicals such as soda, vinegar acid, glycerin, alcohol, nitric acid and sulfur acid. Abu Bakr Er Razidied in 925 at the age of 59-60 (Kaya 2007).

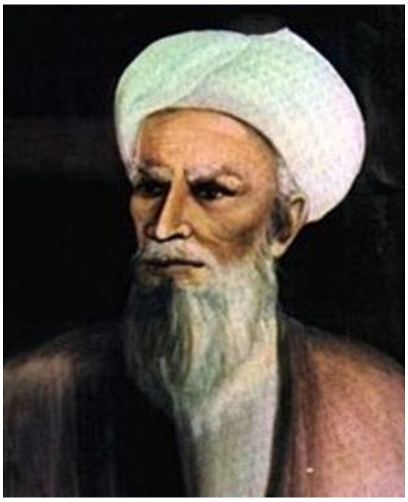

Figure 6. Abu Bakr Al-Razi

1.2.7.Avicenna (980-1037): Avicenna was born in Afshaneh, near Bukhara, Iran, in 980 AD. His father, Abdollah, was a local governor, and his mother's name was Setareh. His intellect has been evident since he was a child. At the age of 10, he finished learning the Koran and important Persian writings, began to learn philosophy and medicine, and became a renowned physician at the age of 18 (Zargaran and friends 2012). Ibn-iSina, knownas Avicenna by the westerners whose real name is Ibn-iSina, is considered one of the most important thinkers and doctors of the golden age of Islam. He hasmany studiesin the field of medicine and related to the treatment of diseases. He is a scientist who has worked not only in the field of medicine, but also in many disciplines such asastronomy, philosophy and chemistry. Using plants,he produced drugsto be used to treat certain diseases and discovered many chemicals (Moosavi 2009).

Ibn Sina has also made great progress in the field of neuroscience, so modern neurology owesa lotto his work. Avicenna died in Iran in 1037 AD at the age of 57 (Zargaran and friends 2012).

Şekil 7. İbn-i Sina (Avicenna)

2. SCİENTİSTS GUİDİNG THE SCİENCE OF CHEMİSTRY

2.1. Joseph Priestley (1733-1804): Joseph Priestley arrivedat Birstall Fieldhead, a small village southwest of Leeds, on 13 March 1733. Jonas Priestley and Mary Swift had their first child, later priestley had three sons and two sisters. Having a large familyand financial difficulties led tothe young Priestley being sent to his grandfather'shousefirst and to his uncle and aunt's house, who had no children afterhismother'sdeath. Priestley's childhood was plagued by turmoil, rejection and mental problems. As a child, Priestley attended many local schools, where he learned Greek, Hebrew and Latin. When his illness prevented him from studying at school, hecontinued hiseducation at home. During these years, Priestley learned geometry and algebra. While studying the work of John Locke and Isaac Watts, he learned Italian, French and High Dutch. In 1752 Priestleystudied at Daventry Academy, as he excluded him from traditional universities. Thanks to young informal teachers and a liberal curriculum , Priestley has improved in Daventry. Priestley enjoyed discipline and hard work here and made warm friendships. Contrary to the rejection and loneliness heexperienced as a child , Priestley was part of a community that thought of him as himself. Thanks to hiseducation, Priestley gained considerable intellectual freedom and independenceofthought (McLachlan 1990).

Priestley was the first scientist to prove that an undefined gas was needed for a combustion reaction, and in his work with Sweden's Carl Scheele, he obtained it purely, discovering oxygen. Priestleynamed itflojistic air, which was later renamed antoine lavoisier oxygen. Joseph Priestleydiscovered nitrous oxide (laughing gas), hydrochloric acid, sulfur dioxide and carbon monoxide gases in his studies in the following years.In 1767, he produced the first drinkable man-made soda(carbonated water) by Joseph Priestley. In 1772, Joseph Priestley published an article called Constant Air Impregnation, explaining how he obtainedcarbonated water. Priestley, however, was not interested in the financial potential of any carbonated water product. On April 5, 1770, Joseph Priestley discovered that Indian gum had the ability to erase pencil marks. These were the first erasers Priestley referred to as rubber (Bellis 2019).

In 1771, Priestleysoughtto improve the polluted air that occurs when a candle burns in an enclosed space. But interventions such as cooling, heating and compressing the air did not helpat all. Butin 1771, he made an extraordinary discovery by chance. First, he killed the rat in a confinedspaceby polluting the air. He thought the same would be true of plants, but it didn't work out as he thought. He repeated the experiment about 10 times in the summer of 1771. First, heobtained toxic air by keeping the fares in a confined space until they died. He then put a stalk of mint in the container and showed that the airhad returned to its former state, in which a candle could burn and a mouse could also live (West 2014).

Priestley wasa dev into religion who developed very liberal views. His theology was severely criticizedby the enlightenment, and eventually his home and equipment were destroyed by the rebels, forcing him to emigrate to America in 1794. He died on February 6, 1804, at the age of 70 in pennsylvania, Usa. (West 2014).

Şekil 8. Joseph Priestley

2.2. Antoine Lavoisier (1743-1795): Antoine Lavoisier, full name Antoine Laurent de Lavoisier, is a French chemist. He was born in Paris on 26August1743. Born into a wealthy Parisian family, he lost his mother as a child. He grows up with his father's interest. Lavoisier, who was initially interested in the field of law, then became interested in science. In his 20s, he developed a lighting project at the French Academy of Sciences that won him a gold medal. Antoine Lavoisier played an active and important role in what was remembered as the chemical revolution. Lavoisier took part in agricultural and financial reform as well as technological development. He took part in many studies such as the creation of the geological map of France, the improvement of agriculture, the creation of a metric system. Lavoisier is commissioned by the French government in the production of gunpowder (Hendry 2012).

Antoine Lavoisier, known as the father of modern chemistry, made important contributions to the establishment of modern chemistry. In the periods although lavoisier's work, substances and reactions were treated as alchemy and were based on ongoing knowledge from ancient times. It has dealt with the scattered studies related to alchemy with a certain integrity (Sour 2019).

In the early days when Lavoisier was admitted to the academy, chemists believed that in order for the combustion event to occur, there had to be a substance called filogiston. Filogiston; it occurs during burning and respiratory reactions and in the opposite cases it is reabsorption. Although this idea initially seemed acceptable to Lavoisier, after many years of experimentation, filogiston argued and accepted the theory of oxidation instead of theory. Before Lavoisier's work, the preservation of mass was not proven by experiments, it was just an assumption. He thought that lavoisier substances were not destroyed by chemical reactions. He wanted to prove that idea through experiments, but he was struggling. Because he was sensitive and meticulous in measuring, he weighed all the substances he used in the reactions he worked on. This sensitivity and diligence helped him form the basis of the Law on the Protection of Mass, also referred to by his own name (Demirhan 2021).

Although Lavoisier worked for France with revolutionary and scientific approaches and continued to do so, the revolutionary courts established with the French Revolution sentenced Lavoisier to death. The reason for his execution was his close ties to the anti-revolutionary aristocracy and a number of scientific studies he did with the taxes he collected. The judges response is still remembered today, although the leaders of that day, who became aware of the situation, demanded lavoisier's forgiveness by showing his contributions to France. The judge replied, "The Republic does not need scholars," and Lavoisier was executed in Paris on 8May 1795, at the age of 51 (Sour 2019).

Figure 9. Antoine Laurent de Lavoisier

2.3. John Dalton (1766-1844): John Dalton was born on 6September 1766, in Eaglesfield, England, to a poor country couple who made a living by hand weaving.As a teenager, Daltonbeganstudying at a cult school that included religious education as well as science, mathematics and grammar classes. His outstanding achievements, especially in mathematics,make Daltonwell-knownin his local community. During his 15 years of continuous teaching, the young man trained hundreds of village childrenand developed himself in mathematics and science (Yildirim 2019).

Dalton was interested in meteorologyin the early years ofhis studies in chemistry.It collected data on air temperature, air pressure and precipitation according to days and seasons. In these studies,he determined that there was water vapor in the air at every temperature and measured the pressure of the water vapor at different temperatures. He has writtenmany articles on concepts such as barometer, thermometre, hygrometer, formation of rain clouds, structure, distribution and evaporation of moisture in the atmosphere.John Dalton put outthe partialpressure scabbth and proved that the gasesthat make up the mixture of the total pressure of a gas mixture are equal to the sum of partial pressures. Dalton's so-called partial pressure law is amongthe results of his early work. Another meaning is that gas particles are independent particlesthat do not affecteach other, and do not haveany pulling or thrustbetween them. he did his work on thetheory and explained mathematically all the properties of gases. Dalton's law applies entirely to ideal gases. Fornon-essential gases, it shows little deviation under normal conditions. Dalton was, in a way, the first scientist to explain chemistry and chemical analysis. According to Dalton, the main function of chemistry is to separate or combine material particles.These particles he mentioned were atoms,the smallest elements of matter that were consideredindegradable and indecible at the time (Dec 2008).

The reason Dalton is referred to as the father of modern atomic theory is that he came up with the results of both his own work and the work of his contemporaries as a theory. In particular , the concept of equivalent grams in the law of folded ratios has shown that there are small particlesin the interior of all elements that are the same and are not divided. In his book published in 1808, he proposed the theory of atoms in the following 5 articles:

1. All substances consist of atoms, which are the smallest unit.
2. There are many atoms that are different in mass and properties. All atoms of one element are identical anddiffer from atoms of other elements. An element is a substance made up of atoms of the same type.
3. Atoms cannot be broken down or recreated.
4. Atoms combine to form molecules. Every molecule of a compound is the same. A molecule is formed by the merging of one or more atoms.
5. Chemical reactions occur by displacement of atoms under certain conditions.

Although the recommendations in Dalton's theory matched the results of the knowledge and experiments of his time, some errors in atomic theory have come to light over the years after the development of science and especially the development of our knowledge of the atomic nucleus. (Dec 2008).

His stroke in 1837 made it difficult for Dalton to teachand continue his studies. John Dalton died on 27July 1844, seven years after he was paralyzed. At his death, Manchester, where he spenta significant part of his life, accepted him as he had done all his life. After his funeral was held at City Hall for four days, a civilian funeral was held (Constable 2022).

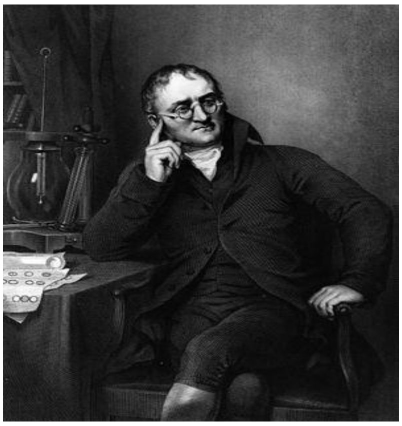

Figure 10. John Dalton

2.4. Amedeo Avogadro (1776-1856): Amedeo Avogadro was born on 9 August 1776 in Turin, Italy. His parents were aristocrats. His father was a Filipino senator and judge with the title of Count. Her mother, Anna Vercellone, was a noblewoman. Amedeo Avogadro was given the title of Count by her father. The full name of Amedeo Avogadro was Count Lorenzo Romano Amedeo Carlo Avogadro di Quaregna e di Cerreto. Avogadro was very smart. In 1796, at the age of 20, he received a PhD in canon law and began working as a church lawyer. Although he continued the family tradition by studying law, after a while he lost interest in legal affairs and turned to science. In 1803, he and his brother Felice wrote and published his first scientific paper examining the electrical behavior of salt solutions (Bayir 2020).

In the early 1800s, scientists' ideas about particles, which we defined as atoms and molecules, were often wrong and limited. Avogadro was deeply interested in understanding the behavior of fundamental particles of matter and how they come together when forming chemical compounds. In 1809, Avogadro began teaching natural sciences at liceo Vericelli high school. Avogadro noticed one thing while experimenting with gas densities: two volumes of water vapor were formed as a result of the combination of two volumes of hydrogen gas with one volume of oxygen gas. Given the understanding of gas densities, Avogadro expected only one volume of water vapor to form at the end of the reaction. The experiment resulted in two, making him think that oxygen particles were made up of two atoms. Avogadro formulated the gas law, known as the Avogadro law, which emphasizes that all gases of the same temperature and pressure have the same number of molecules per volume. Avogadro was not the only one in his work on molecules and gases. Two other scientists, British chemist John Dalton and French chemist Joseph Gay-Lussac, were also researching these subjects. Their work had a strong impact on Avogadro's ideas and work. Dalton is remembered for his atomic theory, which means that all matter is made up of small, indivisible particles called atoms. Gay-Lussac is remembered for its self-named gas pressure-temperature law.

Avogadro wrote a memoir (short note) in which he described the experimental gas law, now known by its own name. Although its discovery is considered a fundamental aspect of chemistry today, it did not receive much attention at the time. According to some historians, Avogadro's work was overlooked by scientists because it worked in relative uncertainty. Although Avogadro was aware of the discoveries of his contemporaries, he did not make any moves to enter the social circles of scientists and did not contact other great scientists until the end of his career. Very few of Avogadro's articles have been translated into German and English during his lifetime. Besides, his ideas were probably ignored because they contradicted the opinions of much more famous scientists.

In 1814, Avogadro published a memoir about gas concentrations, and in 1820 he became the first president of mathematical physics at the University of Turin. As a member of a government commission on weights and measurements, he helped promote and promote the metric system in the Piedmont region of Italy. The standardization of measurements made it easier for scientists living in different regions to understand, compare and evaluate each other's work (Morselli 1984;Datta 2005).

In 1821, when he was head of mathematical physics at the University of Turin, he published another paper on atomic masses and the proportions they merged. Between 1837 and 1841, Avogadro published articles detailing the physics of matter. Almost all of this information was ignored until the information in these articles was presented by StanislaoCannizarro at the Karlsruhe Conference in 1860, four years after Avogadro's death. StanislaoCannizarro was called to this conference to address the scientific confusion about molecules, atoms and their mass. Even after Cannizarro presented his study, there were scientists who disagreed with him. Today, Avogadro is seen as one of the founders of atomic molecular chemistry (Bayır 2020).

One of the most important contributions of Avogadro's work to chemistry was that it solved the unknown found in atoms and molecules (although it did not use the term "atom"). Avogadro believed that particles could consist of molecules, and that molecules could consist of even simpler units (now we call it "atoms"). The number of molecules in a mole (one gram of molecular weight) was called the Avogadro constant in honor of Avogadro's theories. The constant Avogadro was experimentally determined as $6{,}023 \times 10^{23}$ molecules per gram of moles. Avogadro did not calculate this number, but logically mentioned the existence of this number in his hypothesis and study. Avogadro died in Turin on 9 July 1856 at the age of 79, five years after retiring from the University of Turin at the age of 74. Quaregnaya buried (Morselli 1984) (Datta 2005).

Figure 11. Amedeo Avogadro

2.5. Humphry Davy (1778-1829): Humphry Davy was born on 17 December 1778 in Penzance, Cornwal, England. He was the eldest of five children of a small couple who owned a farm. Davy was educated at local schools. He was enthusiastic, popular, caring and intelligent. He had a vivid imagination. He had an interest in writing poetry, fireworks, fishing and collecting mines. When his father died in 1794, he left his wife, Grace Millet Davy, and her family in heavy debt due to failed mining investments. His father's death changed Davy's life, and he was determined to do something with his own efforts and help his mother. A year later, Davy began working as an apprentice with a doctor and pharmacist. He was expecting to have a medical career here. In addition, he developed himself in the fields of philosophy, chemistry, languages and theology. Around this time, he met Gregory Watt, son of The Scotsman scientist James Watt, and Davies Gilbert, who allowed Davy to use his library and chemistry lab. Davy began his experiments here, which are usually related to gases (Bellis 2019).

Davy can be seen to have created his own personality from the newly reformed chemistry discipline. Theoretically and systematically, it followed Antoine Lavoisier's chemical revolution in the late eighteenth century. Davy is seen as the first scientist to discover the electrolytic composition of mineral salts of magnesium, barium, potassium, calcium and sodium. He reflected his own intelligence in his poems and letters. In his lectures at the Royal Institute, he used poetic language and spectacular performances to announce his own scientific ideas. He presented the world of science with spectacular and spectacular shows. In his writings, he described himself as emotionally sensitive to the beauty of nature and adapting to his great powers (Golinski 2011).

Davy began experimenting with nitrous oxide, now known as laughing gas. He conducted experiments on himself that almost resulted in his death and may have negatively affected his health in the long run. He recommended using this gas as a drug in surgical operations, but nitrous oxide began to be used to save lives nearly half a century later. Davy's article on light and heat caught the attention of renowned British doctor and science writer Dr Thomas Beddoes, founder of the Pneumatic Institution, which conducts experiments on the use of gases in the treatment of patients in Bristol. Davy joined Beddoes' institution in 1798 and began working as the chemical manager of the Pneumatic Institution at the age of 19. Here he studied oxides, ammonia and nitrogen. In 1801, Davy was appointed lecturer at the Royal Institute in London, then professor of chemistry. His lessons were getting so much attention that people were lining up long lines to attend his classes. Davy turned to electrochemicals in 1800, which developed when Alessandro Volta invented the volta battery, considered the first electric battery. It found that there was electricity generation in simple electrolytic cells as a result of the chemical effect between opposite charged substances. In addition to harnessing electrical power to conduct experiments and isolate elements, Davy invented the carbon arc, which produces light in the arc between two carbon rods and is seen as the first version of electric light. At the time, the cost of producing a carbon arc power supply was too high, so it was economically impractical. His ongoing work led him to discover pipes, along with his discoveries on sodium and potassium. In his work, he also found the feature that allows chlorine to be used as a bleaching agent. In 1815, Davy invented a lamp that was safe to use in the mines as a result of his work for the Association for the Prevention of Accidents in Coal Mines. In Davy's honor, the lamp was named after him. He was knighted in 1812 and baronet in 1818 for his services to his country and humanity. In 1820, he was elected president of the Royal Society of London. In 1826, he was a founding member of the Zoological Society of London. Davy, whose health began to deteriorate after 1827, died on 29 May 1829 in Geneva, Switzerland, at the age of 50 (Bellis 2019).

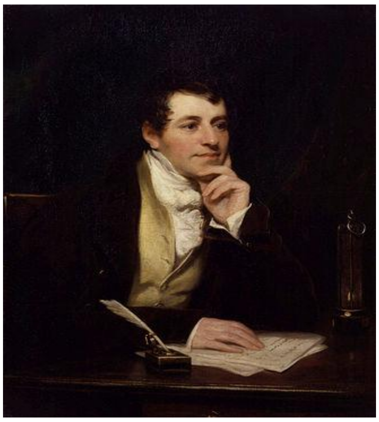

Figure 12. Humphry Davy

2.6. Micheal Faraday (1791-1867): Michael Faraday, an English physicist and chemist, arrived in London on 22 September 1791. His father was a blacksmith. He used to go to church sunday school. In his inadequate and short-lived education here, he learned to read and write and to learn some arithmetic. Faraday, who had three siblings and whose family was not financially well-off, had to enter the working life at an early age.

Faraday attended the conference of Sir Humphrey Davy, one of the most important scientists of the time, at the Royal Institute with a ticket he bought through a client when he was 19. This conference marked a turning point in Faraday's life. Faraday, whose passion for learning was further heightened by what he heard here, seemed unlikely to be cut off from science after that. Faraday, who collected the notes he kept at the conference and parts of his experiments in a book, applied to Davy for an assistantship. When it came to replacing an assistant who was later removed from the Royal Institute, Davy recalled Faraday's application and put him in this position. In 1823, he was elected as a member of the Royal Academy of Sciences, a year later he was appointed Laboratory Director at the Institute where he worked, and in 1833 he became a professor of chemistry. After taking over the Institute, Faraday continued his experiments and revealed the relationships known as the "Faraday Laws". The most important of these is the relationship between the amount of electricity that passes through an item and the amount of components that are separated from that substance. One of the conclusions of this is that atoms are only associated with certain amounts of electricity, which can only be explained by Rutherford's determination of the structure of the atom (Bentli 2007).

Faraday has contributed to a significant part of the changes in our world since he found a very simple but ingenious way to use and produce electricity. Faraday also owns one of the five main laws known as the "5 Equations That Changed the World" (Electromagnetic Induction Law). However, he tried to explain this law by publishing it as a book that contained no equations or even numbers, and luckily read and formulated it after james clerk maxwell, one of the foremost mathematicians of the age, noticed it.

In his experiment with a cage that will be called his own name in the future, Faraday realizes that the electrons in the outerest orbits of the atoms that make up conductive materials are capable of easily breaking away from their atoms and moving. When a conductive object with a closed surface is released into the electric field, it sees that these electrons move until the electric field inside the conductor is zero, protecting the objects against external electrical fields. In summary, conductive surfaces with a closed volume (such as cubes, spheres, rectangular prisms and asymmetric structures) can create an environment completely isolated from external factors. In other words, the Faraday Cage, which causes the phone not to pick up in the elevator or a lightning strike on the plane not affecting the people inside, has shown that an area that is completely isolated from an unwanted external factor can be created (Star 2018).

Michael Faraday invented the first electric motor. Faraday came up with the theory of electrolysis in 1833. Faraday's most important contribution to science is to give science the concept of space. This concept is not only contained in electromagnetic theory, but also einstein's theory of general relativity. Faraday's recent discoveries are the effect of polarized light on the magnetic field and the inability to say. Queen Victoria gave Faraday a house in Hampton Court for her great contribution to science. Michael Faraday, now the prince of experimental science, died on 25 August 1867 at the age of 75 (Bentli 2007).

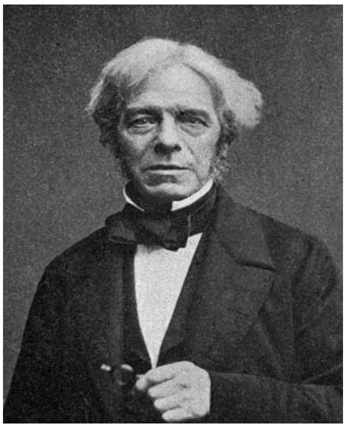

Figure 13. Michael Faraday

2.7. Friedrich Wöhler (1800-1882): Friedrich Wöhler was born on 31July 1800, in Frankfurt, Germany, to Auguste Wöhler and Katherina Schröder, an agricultural engineer and veterinarian. He received a classical education at the Frankfurt Gymnasium, which he attended since 1814, and while he was successful there, he also took up special hobbies. As a child, Friedrich Wöhler was a well-established mineral collector and later, at the age of eighteen, his interest turned to the chemistry of minerals. In letters to his schoolmate Hermann von Meyer, he described his experiments in fragments in his bedroom at his home in Frankfurt. Despite phosphorus burns and broken chlorine bottles in the experiments, oxygen preparation, phosphorus extraction and isolation of potassium were achieved using a 100-plate battery. There was no chemistry education at the Frankfurt Gymnasium. That's why he transferred to Heidelberg a year later. There, Leopold Gmelin asked him not to waste time on chemistry lectures but to work in his own laboratory, and in 1822 Gmelin and Wöhler published a joint paper on cyanide compounds, including the first preparation of platinum and palladium double cyanides(Keen 1985).

Leopold Gmelin decided that Wöhler was too advanced to take advantage of his lessons and sent him to work with the world-renowned Swedish chemist Jöns Jacob Berzelius. A year-long mineral analysis in Stockholm not only provided Wöhler with the best chemistry education of that time, but also led to a close bond between the two that would last a lifetime. Wöhler quickly mastered the Swedish language and later served Berzeliusas both his interpreter and his lawyer in Germany. In1827, Wöhler was able to prepare the first pure aluminum sample. This metal is the third most common element found in the earth's crust, but it has had quite a hard time isolating from its compounds.

Until the 19th century,there was a belief that organic matter could only be produced by living things. Jakop Berzelius pioneered the so-called vitialism, which was believed to require a living environment (life force) to produce organic compounds from systems (inorganic compounds) that do not live in the current. Friedrich Wöhler made a series of efforts to break this taboo in 1824. Wöhler obtained oxalic asid, an organic substance, when he heated the disionegenic substance (non-organic) with water. As a result of Wöhler's heating of ammonium cyanide dry, ammonium obtained a white solid substance that did not conform to the properties of cyanide. This compoundwasurea,a substance completely different from ammonium cyanide. Urea was an organic compound. Wöhler was awarded the title of professor at the age of 28 thanks to this invention he made in 1828. This articlewas presented byBerzelius to the Royal Swedish Academy of Sciences. This invention was chosen as the most important invention made that year. It was argued that the contributions of this invention to isomerism were very large. Wöhler also managed to obtain aluminum metal. Friedrich Wöhler contributed greatlyto the current stateof theperiod ruler. They have contributed greatly to the development of chemistry.From 1820 to 1882, the articles received a lot of attention. His breakthrough was in synthesizing urea, an organic compound, for the first time in a laboratory setting in 1828. Even the two or three studies that Wöhlerhas done deserve the greatest respect and appreciation scientifically, and if hehadn't lived, chemistry would be very different from what it is today. Friedrich Wöhler died in Germany on 23 September 1882 atthe age of 82 (Horseman 2022).

Figure 14. Friedrich Wöhler

2.8.Alfred Nobel (1833-1896): Alfred Nobel, full name Alfred Bernhard Nobel, was a Swedish chemist and engineer. On 21 October 1833, the noun arrived in Stockholm, Sweden. His father, Immanuel Nobel, was an engineer and inventor who made and developed new tools. His father was interested in explosives and machines. Alfred Nobel received special education from teachers until his youth and developed himself in the fields of language and literature. At the age of 17, despite speaking many languages and studying poetry, his father wanted Nobel to become a chemical engineer. That's why he sent the Nobel abroad for his education. During his training, he met Ascanio Sobrero, who studied Nobel nitroglycerin and found it to be a liquid explosive. The Nobel then became interested in nitroglycerine. It studies nitroglycerin, which is stronger than gunpowder and harder to control. His work has given him painful experiences.

In 1864, nobel was working on nitroglycerin in Stockholm when a powerful explosion occurred. As a result of this explosion, Nobel's younger brother Emil dies. Nobel is banned from working in Stockholm following this incident. He continues his Nobel studies elsewhere near Lake Malaren. During his studies, he is very determined to continue his Nobel studies, which were destroyed by violent explosions, and as a result of these studies he finds dynamite. Develops various explosives from nitroglycerin and nitrocellulose. After these studies and inventions, Nobel opened factories and laboratories, continuing to produce dynamite and develop explosives. In addition, the Nobelium element, a synthetic element in memory of Alfred Nobel, was named after him (Sour 2017).

Alfred Nobel and his family made a huge fortune indirectly from the dynamite trade. When his brother Ludvig Nobel died in 1888, french newspapers reported that "The merchant of death is dead." Dr. Alfred Nobel, who got rich by finding a way to kill people quickly, is dead, the report said. The newspapers actually thought Alfred Nobel had lost his life. Nobel, who heard these news stories, was deeply saddened to learn that headlines like these would be put in the newspapers after he passed away. He lived with this sadness in his next life because the companies he founded produced weapons and explosives that killed people and his invention was used in wars. Therefore, when Alfred Nobel died of a brain haemorrhage in San Remo on December 10, 1896 at the age of 63, he requested that a prize be distributed annually to the scientists who served humanity upon his will dated November 27, 1895. For this reason, 32 million 200 thousand kronor (Approximately 14.5 million Turkish Liras) of its wealth is distributed to those who serve humanity every year. On december 10th, when he passed away, a total of 5 awards were given in chemistry, physics, literature, medicine and peace every year. In 1900, the Swedish government founded the Nobel

Foundation. Through the Foundation, nobel prizes are awarded regularly every year. In 1968, the Bank of Sweden decided to award the economic prize annually in memory of the Nobel (Eskier 2017).

Figure 15. Alfred Nobel

2.9. Marie Curie (1867-1934): MariaSalomeaSklodowskaarrived in Warsaw, Poland, on7 November 1867. Bronislawa and Wladyslaw were the youngest of sklodowska's five children. Marie's family was interesting and unusual. His parents were one of the small polish noble families who lost theirland and political power after poland was invaded by Tsarist Russia. When Marie was born, the January 1864 uprising was recently suppressed by Russia and the city ofWarsawwas occupied. One of Bronislawa's brothers was exiled to Siberia; another waswounded twicein thewar and fled to France. Marie'sparents were one of the highly educated families whocared about comprehensive and rigorous education for girls as well as boys. Ailesiwanted her childrento get the best possible education. Marie, like her siblings, was sent to public and private schools, where she was carefully taught in many languages, mathematics and various sciences. Although the training of girls was illegal, Marie receivedan intensive education in Polish history, literature and language. Public discussion of his educationat home and school as a child could lead tothe arrest and deportation ofhis parents and teachers. Marie wasa bright boy with avery good language ability and a great memory. In those years, a woman was supposed to continue her education in another country, as she was unlikely to go to university in Russian-occupied Poland. He and his older sister Bronia, who is two years older than him, made a deal. Marie would work and help Bronia study medicine in Paris, and Bronia would supportMarie'ye whenshe finished school (Rockwell 2003).

Marie chose Becquerel as her phD subject. He found that the thorium element emits the same rays as uranium and gave this radiation a name (Radio activation). He experimented withmineral shoots and discovered a new radioactive substance with similar properties. He called this new element "polonium", inspired by the country of hisbirth. The discovery of radium in 1902 ledtoa great reputation for Curie and his family. This was because radium could be used for cancer treatment in medicine, and the commercial gain it brought. But they were not interested in the commercial dimension of their invention. SoMarie became the first woman to win the Nobel Prize. After the death of his wife Pierre, he was offered his chair at the Sorbonne University, Marie Curie. Birwas given the title of professor for the first time in France. Dedicated entirely to teaching and working, Marie was able to obtain radium in pure metal form. His achievement earned him the 1911 Nobel Prize in Chemistry and made him the first scientist in nobel prize history to be awarded it twice . He used the money he earned from the prize to build the X-ray devices, and he used this technique to make the first prize. He developed it by working with doctors in World War II (Dinçer 2021).

Throughout her life, Marie Curie played an active role as an ambassador for both her own research groupandthe scientific community. His health continued to deteriorate with persistent anemia, lung problems and cataracts, possibly caused by radiation. With atypical desire for privacy.B s discomfort was hidden from everyone, and many (including blindness) were not even known to their students until after his death. Marie Curie died on 4 July 1935,at theage of 66. Although the cause of his death was explained as aplastic anemia at the time, anemia is now thought to actually have a secondary effect on radiation-related leukemia (Rockwell 2003).

Figure 16. Marie Curie

2.10.Karl Ziegler (1898-1973): Karl Ziegler was bornon 26November 1898, in Helsa, near Kassel, Germany, the second son of Karl Ziegler and Luise Rall Ziegler. Ziegler'sinterest in biliation came fromthetextbook of introduction physics. This led him to conduct experiments at home and read extensively beyond the high school curriculum. In addition, his work and experimentsgave him the award of most outstanding student in his final yearat high school in Kassel, Germany. He studied at the university in Marburg, Germany, and was able to skip his first two semesters due to extensive background knowledge.In 1920, Ziegler received his Doctorate from Karl von Auwers for his work on his thesis on "Studies on Semibenzol and related connections". He taught briefly at the University of Marburg and the UniversityofFrankfurt. In 1923, Karl Ziegler described the synthesis of phenylizopropylpotasium as a dark red, highly reactive organometallic compound, which was used years later to test the impurities of solvents or gases. In 1926, he became a professor at the University of Heidelberg and spent thenext decade researching new developments in organic chemistry. He investigated the stability of radicals on trivalued carbons, which led him to study organometallic compounds and their application in their research. He also studied the synthesis of multi-member ring systems. In 1933, Zielger published VielgliedrigeRingsysteme, his first major study of large ring systems, which laid the foundations of the Ruggli-Ziegler dilution principle. Karl Ziegler was commissioned for the postwar resurrection of chemical research in Germany and helped found the German Chemical Society (Gesellschaft Deutscher Chemiker) in 1949. (Sack 2017).He studied and experimented with ziegler's free radicals, organometallics, ring compounds and polymerization processes. The first reactions were related to alkaline metals: the first organometallic synthesis involved the addition of an organo-potassium compound to a C=C bond. This played an important role in research into the polymerization mechanism ofsodium andbutane.Organo-lithium chemistry was related to the development of a new synthesis of butillityum. Attemptsto add lithium hydride to olefins were unsuccessfulin the first attempts. The expansion of Bu typesofreactions for lithium aluminum hydride led to increased interest in organo-aluminum chemistry and the discovery of the Aufbau reaction. Trietylluminium reacts with ethane to give higher aluminum trialkiller, a process that is still of great technical importance for the production of biodegradable detergents. Unexpectedly, in an experiment, "Aufbau" was interrupted and consisted only of butane. An auxiliary catalyst was included, but its nature could not be determined at first. After hectic studies, it became clear that nickel traces acted like poison, and this event became known as 973626 the "Nickel effect" led to a numbered German patent. This patent included a combination of aluminum alkils and compounds of Ti, Zr, Hf, V, Nb, Ta, Cr, Mo and W metals as catalysts for the polymerization of ethylene. Ten years later, Karl Ziegler won the Nobel Prize with Guilio Natta. Today, multibillion-dollar production is being made worldwide based on Ziegler-Catalysts. Karl Zieglerdied on 12 August 1973 in Mülheim, Germany, at the age of 74 (Wilke 1995).

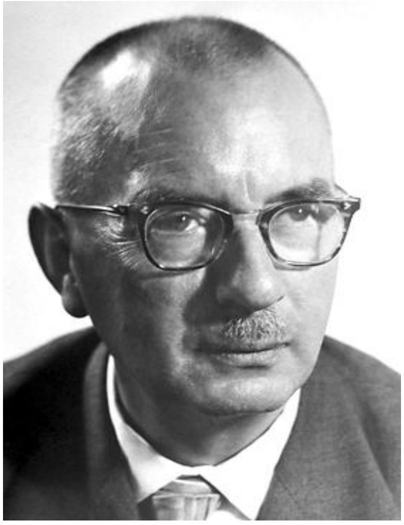

Figure 17. Karl Ziegler

3. CONCLUSIONS AND RECOMMENDATIONS

In previous chapters, the lives of some personalities who shaped the history of chemical science were explained. In this conclusion section, we will briefly discuss some aspects of the interaction between chemistry and society. Everything you hear, see, smell, taste and touch involves chemistry and chemicals, and hearing, seeing, tasting and touching is the result of a complex set of chemical reactions and interactions in your body. So, even if you don't work as a chemist, you do something that contains chemistry in almost everything you do. In everyday life, you do chemistry when you cook, use cleaning detergents to clean your countertops, take medication or dilute concentrated juice with water so that it does not taste too intense. The reason why chemistry touches everything we do is that almost everything that exists can be divided into chemical building blocks. The main building blocks in chemistry are chemical elements, substances consisting of a single atom. Each chemical is unique, consisting of a certain number of protons, neutrons and electrons. In 1785-1873, new scientific and technological developments in chemistry and electricity caused a radical change in the lives of the people living in the 19th century. With steam engines developing in the early 19th century, it caused significant changes in production, transportation and social life. With the use of steam machines in factories, production began to mechanize rapidly. With these developments, a new social class emerged. Technological developments with the discovery of electricity have caused a great change in the quality of public life. Electricity has accelerated production and increased efficiency. Advances in mechanization and motor technology have led to increased production in agriculture. Major industrial cities began to be established. Houses, streets and streets lit up. There have been huge increases in the number of people living in cities. It has led to great improvements in communication and transportation.

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