

The practice and history of alchemy chemistry essay



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Alchemy, derived from the Arabic word al-kimia (الكيمياء, AL-KIMIYAH), is both a philosophy and an ancient practice focused on the attempt to change base metals into gold, investigating the preparation of the “elixir of longevity”, and achieving ultimate wisdom, involving the improvement of the alchemist as well as the making of several substances described as possessing unusual properties. The practical aspect of alchemy can be viewed as a protoscience, having generated the basics of modern inorganic chemistry, namely concerning procedures, equipment and the identification and use of many current substances.

Alchemy has been practiced in ancient Egypt, Mesopotamia (modern Iraq), India, Persia (modern Iran), China, Japan, Korea, the classical Greco-Roman world, the medieval Islamic world, and then medieval Europe up to the 20th century and 21st Century, in a complex network of schools and philosophical systems spanning at least 2,500 years.

HISTORY

What existed before modern Chemistry?

After the death of Alexander the Great of Macedon (323 B. C.), much of the conquered territories in the Persian Empire that were located in the Middle East and northern Africa, began to dissolve. Ptolemy, one of Alexander's generals, established a kingdom on the coast-line of Egypt.

As its capital, Alexandria was considered to be one of the most culturally diverse cities in the world at that time; Ptolemy and Ptolemy II founded the

Temple to The Muses, otherwise known as “ The Museum”, to continue scholarly activities and studies of the day.

“ The Museum” could be considered an equivalent to a university or a research institution by today’s standards.

At the Temple of The Muses, Greek philosophy, considered to be the basis for western-scientific ideas and reasoning, fused with local Egyptian khemeia, the ancient art, religion, and ceremonies of embalming the dead to create Greek-Egyptian khemia. Because the art of khemeia had been shrouded in mysticism, religion, and the secretive language of obscure symbols, common people were afraid of the practitioners and their seemingly dangerous yet powerful knowledge of chemicals.

There were two major unfortunate byproducts of Greek-Egyptian khemeia that were a result of these cryptic practices and obscure languages and symbols. First, the secretive nature of this field slowed its progression so that no one could profit from another’s mistakes or learn from another’s brilliance. Secondly, anyone who spoke in the obscure languages and symbols of Greek- Egyptian khemeia couldn’t be understood, so just about anyone who could make up nonsensical words could pass as a scholar.

As time passed, Greek-Egyptian khemeia began to fall further into obscurity, where shadowy practices of wizardry, magic, and sorcery seemed to flourish in mysticism. Of these, a Greek- Egyptian by the name of Bolos of Mendes (c. 200 B. C.) promised a tool which would allow for ways of turning common metals, such as lead and iron, into gold and silver. Although it was not

completely understood how this would be done, this tool, referred to as The <https://assignbuster.com/the-practice-and-history-of-alchemy-chemistry-essay/>

Philosopher's Stone, was the dream of many. Although The Philosopher's Stone has never been found, the actual search for it has assisted in the study of metallurgy and methodologies of modern day chemistry by refining many of the practical laboratory techniques, skills, and glassware that are still used today, such as those used in distillation, filtration, crystallization, coagulation, evaporation, and extraction.

In 4th century A. D., because Roman Emperor Diocletian feared that a cheap source of silver and gold could bankrupt the already shaky Roman economy and Pope Zosimus's recognition that Greek-Egyptian khemeia was a practice of "pagan learning", little was done to stop the destruction of the Alexandrian Museum and its libraries by Christian riots. As a result, the study of Greek-Egyptian khemeia went underground and would remain as a hidden practice until the 7th century, where it emerged in the middle-east.

In the early 7th century, Arabic tribes unified and began to conquer much of the middle-east, western Asia, and northern Africa. These conquering armies soon began to march on Eastern Europe, where the inhabitants of Constantinople, with the help of a khemeia practicing Greek-Egyptian named Callinicus, used Greek fire as a form of defense against the intruders (670 A. D.). Greek Fire, a flammable mixture of sulphur, namptha, and quicklime, was placed into a bronze tube, mounted on a castle wall or the bow of a ship, and was lit by a torch to spout fire at anyone who approached. Although this method was able to stave off some of the attacks by land and sea, the Arabic forces soon gained control of Constantinople, discovered the philosophy of Greek science, and began to utilize the practices of Greek-Egyptian khemeia for their benefit.

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In Arabic, Greek-Egyptian khemeia was translated into the term al-kimiya, flourishing not only as a science of metallurgy, but with the guidance of Jabir ibn-Hayann (c. 760-815A. D.), its use in medicine as well.

It was Al-Razi (c. 850- 925A. D.), however, who perfected the use of plaster of Paris in mending broken bone, His meticulous ability to logically organize his notes and writings showed the importance of clarity with laboratory procedures to the point where he became the first to document and describe the comparisons between smallpox and chickenpox.

Many of his works were translated into Latin nearly 600 years later and made an impact on lab methodologies of performing medicine and other experimental research that are still used today.

With all of the practical aspects that al-kimiya had to offer, it always had a way of returning to the mystical and what we may refer to today as non-scientific practices. Not only was there a search for The Philosopher's Stone, but with a broadened focus on medicines within al-kimiya, finding a single cure for all sicknesses, The Elixir of Life, and discovering a potion for maintaining youth, The Fountain of Youth, became some of the new mystical treasures. With these new promises of magical discovery, al-kimiya remained in a shroud of mystery and the study of chemicals was still considered a dark craft.

As western European Crusaders clashed with Arabic Armies in the southern and eastern Europe, an intermingling of ideas and different cultures gave way to growth and appreciation of Arabic arts, science, and mathematics in

the west. By the time the last Moorish strongholds in Western Europe were pushed from Spain and Portugal in the 15th century, it became ever so clear that the Latin translations of Arabic sciences and mathematics would forever change the west, thus bringing a close to The Medieval Ages and an opening to the Scientific Renaissance.

Known as alchemy, by the Latin translation from the Arabic term al-kimiya, its practice thrived in Europe after being gone for nearly 800 years. Although it was still considered “pagan learning” in some circles, it thrived in underground communities where the search for the three mystic treasures of The Philosophers Stone, the Elixir of Life, and the Fountain of Youth continued.

As Bombastus von Hohenheim (1493-1541A. D.), better known as Paracelsus, studied the medical works of earlier alchemists, in particular Al-Razi, he believed that searching for cures by alchemical means could have a large impact on medicine, also. Until Paracelsus, only organic plant preparations were used for cures and remedies in treating diseases, but he believed that minerals synthesized in the lab were the key to the future of health care. Although he gained many followers, his efforts wouldn't be recognized by traditional European medicine, since he was considered an alchemist. In fact, it would be well over a century after his death until others would recognize his efforts and put them into practice.

One of Paracelsus' followers and fellow practitioner of alchemy, Andreas Libau (1540-1616A. D.), wanted to bring more clarity and rationality to this field. In 1597 he published *ALCHEMIA*, which summarized medieval

achievements of alchemy, writing with clarity and with minimal mysticism. When theories based upon mysticism were unavoidable, he would reluctantly include them and refer to them as “ Paracelsians”. This book was revolutionary for the field of medicine, the emerging field of a more scientific-based alchemy, and for western science in general because it was one of the first known attempts in separating scientific facts of chemistry from mysticism.

Like Al-Razi, Andreas Libau set a standard for alchemists by documentation of important laboratory methods and skills in the preparation of medicinal chemicals within his publications, explaining how mineral salts and acids could be used as curing ailments. It wasn't until Johann Rudolf Glauber (1604-1668A. D.), however, that laboratory method and procedures would lead to the synthesis of Sodium Sulfate, $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}(\text{s})$, also known as “ Glauber's Salt”. He found that it not only made a mild laxative for medicinal purposes, but when produced in mass quantities it could be commercialized to the general public to make a profit.

Etymology

The word alchemy derives from the Old French alquimie, which is from the Medieval Latin alchimia, and which is in turn from the Arabic al-kimia (أَلْكِيمِيَّة, أَلْكِيمِيَّة...أَلْكِيمِيَّة). This term itself is derived from the Ancient Greek chemeia (χημία) with the addition of the Arabic definite article al- (أَلْ-). It used to be thought that the ancient Greek word was originally derived in its turn from “ Chemia” (χημία), a version of the Egyptian name for Egypt, which was itself based on the Ancient Egyptian word kꜣme (hieroglyphic Khmi, black earth, as opposed to desert sand).
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Some now think that the word originally derived from *chumeia* (ἄμειμα) meaning “mixture” and referring to pharmaceutical chemistry. With the later rise of alchemy in Alexandria, the word may have been mistakenly thought by ancient writers to derive from *chyma* (ἄλχημα), and thus became spelt as *chymia* (ἄλχημα), and the original meaning forgotten. The question of the etymology of the word alchemy is still open, and recent research indicates that the Egyptian derivation of the word may be valid.

Alchemy as a philosophical and spiritual discipline

Alchemy became known as the spagyric art after Greek words meaning to separate and to join together in the 16th century, the word probably being coined by Paracelsus. Compare this with one of the dictums of Alchemy in Latin: *Solve et Coagula* - Separate, and Join Together (or “dissolve and coagulate”).

The best-known goals of the alchemists were the transmutation of common metals into gold (called *chrysopoeia*) or silver (less well known is plant alchemy, or “spagyric”); the creation of a “panacea”, or the elixir of life, a remedy that, it was supposed, would cure all diseases and prolong life indefinitely; and the discovery of a universal solvent. Although these were not the only uses for the discipline, they were the ones most documented and well-known. Certain Hermetic schools argue that the transmutation of lead into gold is analogical for the transmutation of the physical body (Saturn or lead) into (Gold) with the goal of attaining immortality. This is described as Internal Alchemy. Starting with the Middle Ages, Persian and European alchemists invested much effort in the search for the “philosopher’s stone”, a legendary substance that was believed to be an essential ingredient for <https://assignbuster.com/the-practice-and-history-of-alchemy-chemistry-essay/>

either or both of those goals. Pope John XXII issued a bull against alchemical counterfeiting, and the Cistercians banned the practice amongst their members. In 1403, Henry IV of England banned the practice of Alchemy. In the late 14th century, Piers the Ploughman and Chaucer both painted unflattering pictures of Alchemists as thieves and liars. By contrast, Rudolf II, Holy Roman Emperor, in the late 16th century, sponsored various alchemists in their work at his court in Prague.

It is a popular belief that Alchemists made contributions to the “ chemical” industries of the day-ore testing and refining, metalworking, production of gunpowder, ink, dyes, paints, cosmetics, leather tanning, ceramics, glass manufacture, preparation of extracts, liquors, and so on (it seems that the preparation of aqua vitae, the “ water of life”, was a fairly popular “ experiment” among European alchemists). Alchemists contributed distillation to Western Europe. The double origin of Alchemy in Greek philosophy as well as in Egyptian and Mesopotamian technology set, from the start, a double approach: the technological, operative one, which Marie-Louise von Franz call extravert, and the mystic, contemplative, psychological one, which von Franz names as introvert. These are not mutually exclusive, but complementary instead, as meditation requires practice in the real world, and conversely.

Several early alchemists, such as Zosimos of Panopolis, are recorded as viewing alchemy as a spiritual discipline, and, in the Middle Ages, metaphysical aspects, substances, physical states, and molecular material processes as mere metaphors for spiritual entities, spiritual states, and, ultimately, transformations. In this sense, the literal meanings of ‘ Alchemical
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Formulas' were a blind, hiding their true spiritual philosophy, which being at odds with the Medieval Christian Church was a necessity that could have otherwise led them to the "stake and rack" of the Inquisition under charges of heresy. Thus, both the transmutation of common metals into gold and the universal panacea symbolized evolution from an imperfect, diseased, corruptible, and ephemeral state towards a perfect, healthy, incorruptible, and everlasting state; and the philosopher's stone then represented a mystic key that would make this evolution possible. Applied to the alchemist himself, the twin goal symbolized his evolution from ignorance to enlightenment, and the stone represented a hidden spiritual truth or power that would lead to that goal. In texts that are written according to this view, the cryptic alchemical symbols, diagrams, and textual imagery of late alchemical works typically contain multiple layers of meanings, allegories, and references to other equally cryptic works; and must be laboriously "decoded" in order to discover their true meaning.

Psychology

Alchemical symbolism has been occasionally used by psychologists and philosophers. Carl Jung reexamined alchemical symbolism and theory and began to show the inner meaning of alchemical work as a spiritual path. Alchemical philosophy, symbols and methods have enjoyed something of a renaissance in post-modern contexts.

Jung saw alchemy as a Western proto-psychology dedicated to the achievement of individuation. In his interpretation, alchemy was the vessel by which Gnosticism survived its various purges into the Renaissance, a concept also followed by others such as Stephan A. Hoeller. In this sense, <https://assignbuster.com/the-practice-and-history-of-alchemy-chemistry-essay/>

Jung viewed alchemy as comparable to Yoga of the East, as and more adequate to the Western mind than Eastern religions and philosophies. The practice of Alchemy seemed to change the mind and spirit of the Alchemist. Conversely, spontaneous changes on the mind of Western people undergoing any important stage in individuation seems to produce, on occasion, imagery known to Alchemy and relevant to the person's situation.

His interpretation of Chinese alchemical texts in terms of his analytical psychology also served the function of comparing Eastern and Western alchemical imagery and core concepts and hence its possible inner sources (archetypes).

Marie-Louise von Franz, a disciple of Jung, continued Jung's studies on Alchemy and its psychological meaning.

Alchemy as a subject of historical research

The history of alchemy has become a vigorous academic field. As the obscure hermetic language of the alchemists is gradually being “deciphered”, historians are becoming more aware of the intellectual connections between that discipline and other facets of Western cultural history, such as the sociology and psychology of the intellectual communities, kabbalism, spiritualism, Rosicrucianism, and other mystic movements, cryptography, witchcraft, and the evolution of science and philosophy.

Modern connections to alchemy

Persian alchemy was a forerunner of modern scientific chemistry. Alchemists used many of the same laboratory tools that are used today. These tools were not usually sturdy or in good condition, especially during the medieval period of Europe. Many transmutation attempts failed when alchemists unwittingly made unstable chemicals. This was made worse by the unsafe conditions in which the alchemists worked.

Up to the 16th century, alchemy was considered serious science in Europe; for instance, Isaac Newton devoted considerably more of his writing to the study of alchemy (see Isaac Newton's occult studies) than he did to either optics or physics, for which he is famous. Other eminent alchemists of the Western world are Roger Bacon, Saint Thomas Aquinas, Tycho Brahe, Thomas Browne, and Parmigianino. The decline of alchemy began in the 18th century with the birth of modern chemistry, which provided a more precise and reliable framework for matter transmutations and medicine, within a new grand design of the universe based on rational materialism.

Alchemy in traditional medicine

Traditional medicines involve transmutation by alchemy, using pharmacological or a combination of pharmacological and spiritual techniques. In Chinese medicine the alchemical traditions of pao zhi will transform the nature of the temperature, taste, body part accessed or toxicity. In Ayurveda the samskaras are used to transform heavy metals and toxic herbs in a way that removes their toxicity. These processes are actively used to the present day.

Nuclear transmutation

In 1919, Ernest Rutherford used artificial disintegration to convert nitrogen into oxygen. From then on, this sort of scientific transmutation has been routinely performed in many nuclear physics-related laboratories and facilities, like particle accelerators, nuclear power stations and nuclear weapons as a by-product of fission and other physical processes.

In literature

Sir Thomas Malory uses Alchemy as a motif that underlies the personal, psychological, and aesthetic development of Sir Gareth of Orkney in *Le Morte d'Arthur*. Sir Gareth's quest parallels the process of Alchemy in that he first undergoes the nigredo phase by defeating the black knight and wearing his armor. After this, Gareth defeats knights representing the four elements, thereby subsuming their power. In fighting and defeating the Red Knight (the overall purpose of his quest) he undergoes and passes the rubedo phase. Gareth, toward the end of his quest, accepts a ring from his paramour, Lyonesse, which transforms his armor into being multicolored. This alludes to the panchromatic philosopher's stone, and while he is in multicolored armor, he is unbeatable.

A play by Ben Jonson, *The Alchemist*, is a satirical and skeptical take on the subject.

Part 2 of Goethe's *Faust*, is full of alchemical symbolism. According to *Hermetic Fictions: Alchemy and Irony in the Novel* (Keele University Press, 1995), by David Meakin, alchemy is also featured in such novels and poems as those by William Godwin, Percy Bysshe Shelley, Emile Zola, Jules Verne,

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Marcel Proust, Thomas Mann, Hermann Hesse, James Joyce, Gustav Meyrink, Lindsay Clarke, Marguerite Yourcenar, Umberto Eco, Michel Butor, Paulo Coelho, Amanda Quick, Gabriel García Marquez and Maria Szepes.

Hilary Mantel, in her novel *Fludd* (1989, Penguin), mentions the spagyric art. ' After separation, drying out, moistening, dissolving, coagulating, fermenting, comes purification, recombination: the creation of substances the world until now has never beheld. This is the opus contra naturam, this is the spagyric art, this is the Alchymical Wedding'.

In Dante's *Inferno*, it is placed within the Tenth ring of the 8th circle.

In *Harry Potter and the Philosopher's Stone*, there are several references to Nicholas Flamel, and a stone that could turn metal into gold and create an elixir of immortality was sought after by both the villains and Harry and friends, for different reasons.

In contemporary art

In the twentieth century alchemy was a profoundly important source of inspiration for the Surrealist artist Max Ernst, who used the symbolism of alchemy to inform and guide his work. M. E. Warlick wrote his *Max Ernst and Alchemy* describing this relationship in detail.

Contemporary artists use alchemy as inspiring subject matter, like Odd Nerdrum, whose interest has been noted by Richard Vine, and the painter Michael Pearce, whose interest in alchemy dominates his work. His works *Fama* and *the Aviator's Dream* particularly express alchemical ideas in a painted allegory.

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The Rise and Demise of Phlogiston, the Birth of Modern Chemistry, and the importance of Measurement

Chemistry (1600A. D. to present)

Originated and published by J. J. Becher in the late 17th century journal *Opuscula Chymica Rariora*, roughly translated as 'The Work of Rare Chemistry', it was known as the first attempts to explain chemical burning and rusting. Becher said that many common day materials contained a substance called phlogiston, translated from Greek, meaning 'to set on fire'. G. E. Stahl, a medical doctor of the same time period and a proponent of phlogiston, explained in a separate publication that:

" all inflammable objects contained phlogiston which made it possible for them to burn, and as the object burned, phlogiston was poured out into the air. Wood and coal contained a great deal of it, the ashes left after burning did not."

Since communication of scientific discoveries was now common place, Stahl supported his theory with meticulous laboratory procedures and qualitative observations. Some of the qualitative observations he made while burning phlogiston rich substances are listed below:

1. Flames extinguish in airtight space because air becomes saturated with phlogiston.
2. Charcoal leaves little residue upon burning because it is nearly pure phlogiston.

3. Mice die in airtight space because air saturates with phlogiston.

Phlogiston was considered to be a massless or near massless substance, since no measurement device had ever existed that could experimentally measure it. Because of this inability to quantify the mass of phlogiston, qualitative experimentation, which was limited to the description of the five human senses of sight, sound, smell, taste, and touch, was the only way in which the phlogiston theory could be supported.

Another qualitative evidence of phlogiston theory was the white powder residue or rust that was found on the surface of tin after it was heated in the air. Also referred to as calx, meaning 'limestone', it was believed that this is what remained after phlogiston left the tin metal.

Working from previous tin experiments, Antoine Lavoisier (1743- 1794A. D.), a master of building precision instrumentation, attempted to determine the mass of phlogiston with a mass balance that he had manufactured. After evacuating air from a glass vessel that contained tin Filings, he then sealed and began to heat it on his precision mass balance. If the phlogiston theory were correct, he could open the vessel let the phlogiston escape, and finally quantify a value that had eluded scientists for 5 decades.

As Lavoisier opened the heated glass vessel, he instead measured a small increase in mass, which went against the phlogiston theory altogether.

Although other scientists who held steadfast to the phlogiston theory would make rebuttals that phlogiston must then have a negative mass, these attempts would fall short as other experiments that utilized precision

measurements began to compile. For the first time in history, Lavoisier
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showed that a carefully designed experiment using precision measurement technology could be used as evidence to disprove a theory. More important than disproving the phlogiston theory was the realization that precision instruments yielded important quantitative information about the field of chemistry.

Less than a decade later, Lavoisier published his Elementary Treatise of Chemistry (1789), which is considered the first modern chemistry textbook. In it, one could find a well documented view of The Law of Conservation of Mass and the rejection of the existence of phlogiston, along with various new chemistry theories and laboratory techniques that relied upon BOTH qualitative descriptions and quantitative measurements with the help of measurement technology. It not to say that Lavoisier had all the correct theories within his treatise, but rather that the field of modern day chemistry would emerge, depending more heavily upon precision measurements of chemical phenomena rather than the mystical notions of alchemy, like phlogiston and the three mystic treasures.