

EARLY STUDIES ON COMBUSTION

OVERVIEW

Two kinds of chemical change which investigated side by side :

1. Combustion
2. The calcination of metals

The effect of heat on substances :

“the metals, except gold and silver, were found to change when heated in open crucibles and to leave a dross, which was called a calx (lime)”

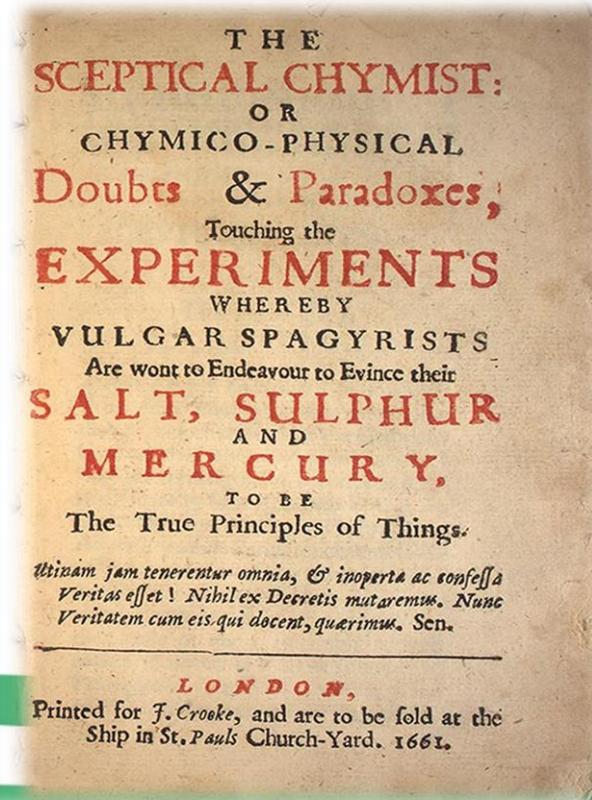
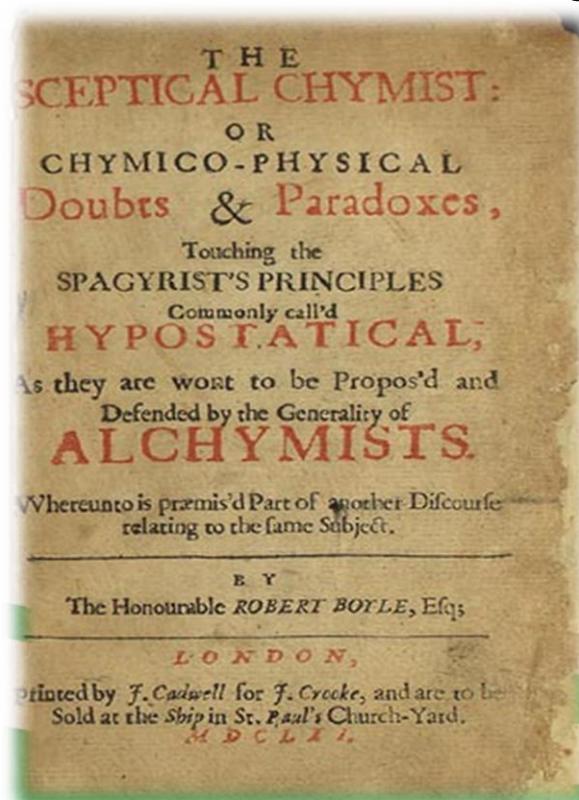
The explanations (16th century) :

“some kind of ‘soul’ escaped from the metal, or the matter became denser, or some kind of acid was absorbed from the fire, or the fire possessed weight and was absorbed by the metal in forming the calx”

BOYLE

Boyle (Robert Boyle) was born in Lismore Castle (Ireland) in January, 25th 1627 and died in December, 31th 1691 in London (England).

Boyle describes of the element on his book, "[the sceptical chymist](#)". In his book, Boyle says that salt, sulphur and mercury cannot be extracted from gold.



BOYLE

Boyle has been called the founder of modern chemistry for three reasons :

1. He realized that chemistry is worthy of study for its own sake and not merely as an aid to medicine or as alchemy
2. He introduced a rigorous experimental method into chemistry
3. He gave a clear definition of an element and showed by experiment that the four elements of Aristotle and three principles of the alchemists (mercury, sulphur and salt) did not deserve to be called elements at all, since none of them could be extracted from bodies.



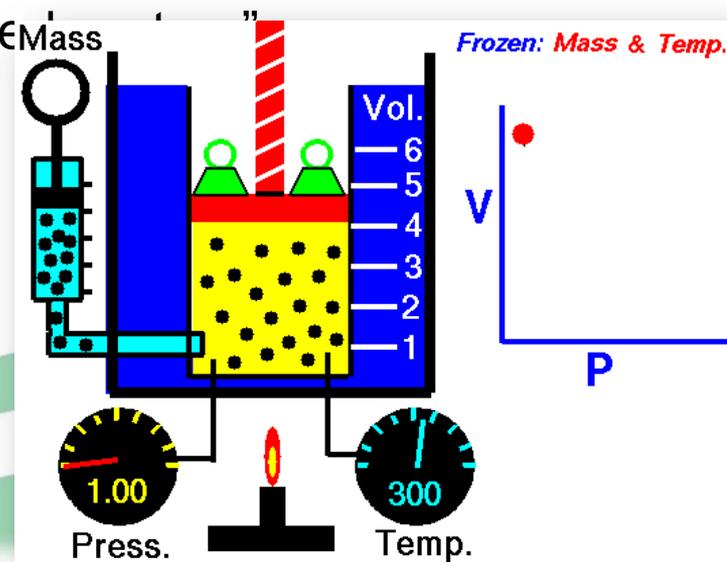
BOYLE

Boyle's definition of an element is as follow (*Sceptical Chymist*) :

“I mean by Elements certain Primitive and Simple, or perfectly unmingled bodies; which not being made of any other bodies, or of one another, are the Ingredients of which all those call'd perfectly mixt Bodies are immediately compounded and into which they are ultimately resolved”

Boyle's Law (1662 and sometimes called Boyle-Mariotte's law) :

“the volume of a gas is inversely proportional to the pressure, if temperature is kept constant within a close



BOYLE

On his book, *General History of the Air*, Boyle concluded that air composed of at least three parts :

1. Vapours from water and living animals
2. A very subtle emanation from the earth's magnetism, producing the sensation of light
3. A fluid, compressible and dilatable, having weight and able to refract light

Boyle's experiment with gunpowder is interesting :

When gunpowder dropped upon the heated plate in vacuum, the powder burned slowly but did not explode : "we saw a pretty broad blue flame like brimstone, which lasted so long as we could not but wonder at it"

Boyle remarked that the glow gradually disappears when phosphorus is shut up in a glass tube and hence he concluded that "the air had some vital substance preyed upon or else tamed by the fumes of phosphorus"

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BOYLE

On his book, *New Experiment to Mae Fire and Flame Stable and Ponderable* (1673), Boyle concluded that air had a weight. Boyle found that 8 oz. of block tin when heated in an open flask increased in weight by 12 grain. Then he explained that the increase in weight was gained by the operation of fire on the metal.

On another books, *Experiment ... Touching Colour* (1664) and *The Reflectionss upon the Hypothesis of Alkali and Acidum* (1675), Boyle gives some general properties of acids and alkalis, such as the sour taste of acids, their action as solvents, their action on vegetable colours (indicators) and their reaction with alkalis (the formation of a neutral salt). On this books, Boyle mentions the green colour imparted to a flame by copper salts, the white fumes produced with ammonia and nitric and hipocloric acid, the white precipitate formed by calcium salts with sulphuric acid and the precipitation of silver salts by chlorides.