

When finely divided iron—ferrum redactum—is heated in air it burns; and that the product of combustion weighs more than the iron consumed may be shewn by dipping the poles of a horse-shoe magnet in the iron powder, hanging it on a balance, and setting fire to the iron with a spirit lamp—a dish should be placed in the pan to catch any particles that may drop off.

If however the combustion be carried out in a closed bottle of oxygen,¹ no change of weight occurs. The iron may be held in a small cylinder two inches long, closed at the bottom and attached to a stout wire passing through the cork; it may be ignited electrically by means of a second wire which also passes through the cork and touches the surface of the powder near the cylinder. After shewing that the weight is unaffected by the reaction, the ignition wire may be pulled out, air will rush in, and the balance will shew an increase of weight.

The explanation of the gain in weight in the first experiment, then, is that the product of combustion contains one of the constituents of the air. That air itself has weight may be shewn in a very convincing manner by pumping it with a bicycle pump or rubber syringe into a common round quart bottle provided with a cork and tap,² well tied in, and weighing before and after.

If hydrochloric acid be poured on baking soda there is violent effervescence and a loss of weight; the soda may be placed in a beaker on the pan of the balance, and the acid in a test-tube standing in the beaker; after balancing, mix. If the same reaction be carried out in the bottle which served for weighing the air (the acid in a test-tube as before, and the mixing effected by tilting the bottle) the weight remains unchanged, but when the tap is opened carbon dioxide escapes and the pan rises. Four grammes of sodium bicarbonate is a safe amount to take if the bottle holds a quart; rocc of concentrated hydrochloric acid is sufficient.

The well known experiment to demonstrate that the products of combustion of a candle weigh more than the candle itself may also be shewn in this connection. The flame must be protected by a piece of tin or brass fixed a little below the gauze, or drops of liquid falling from the potash may extinguish it.

¹ A common round bottle holding about a quart will serve very well; the cork should fit tight and be well vaselined; the holes for the wire (telegraph wire) may be made with an awl, if the wires be sharpened at the end and vaselined they will pass through air-tight. The cylinder to hold the iron powder may be made by wrapping fine wire gauze round the rod of a retort-stand and hammering in the end. If the 110 volt circuit be used for firing, four 16 c.p. lamps in parallel may be used as a rheostat; a bend in the ignition wire outside the cork helps to pull it out.

² A glass-tap will do, or one of the small brass "petcocks" used on the gauges of steam boilers.