it was at once charged, as in Experiment 9. The same was the case when solid silica was employed, but hardly any luminosity appeared.

13. All these experiments were repeated with glass glow-bulbs, but the effects were minute in comparison with those produced when silica was used, and it was found that considerable leakage back of a charge took place when glass was used.

14. An electrical machine is now being constructed by me, in which silica and mercury will be used on a far larger scale than in the experiments described in this paper.

I wish to thank Mr. H. G. Lacell, of the Silica Syndicate, for the great care with which the glow-bulbs have been prepared under his supervision.

On the Atomic Weight of Chlorine.

By Edward C. Edgar, D.Sc., Assistant Lecturer in Chemistry in the University of Manchester.

(Communicated by Professor H. B. Dixon, F.R.S. Received and Read June 25, 1908.)

(Abstract.)

Six years ago Professor Dixon and I began a research with the object of determining directly the weight of chlorine which combines with the unit weight of hydrogen. Our method was to burn a jet of hydrogen in an atmosphere of chlorine; hydrogen being stored and weighed in palladium, the chlorine being condensed and weighed as liquid. The number we obtained for the combining weight of chlorine was appreciably higher than that found indirectly by Stas, and still higher than that approved by the International Committee on Atomic Weights.

While this research was in progress, other determinations had been made bearing on the relative weights of silver, chlorine, and nitrogen, so that some modification in the accepted values of one or more of these elements appeared inevitable. The direct “joining up” of the two ends of the chain connecting hydrogen with chlorine thus became a matter of immediate importance. Since the method of burning one gas in an atmosphere of the other had been proved to be accurate within fairly narrow limits, I was encouraged to continue the investigation, and to modify the apparatus, with a view to
eliminate some of the possible sources of error in the former series of 

experiments.

The most important source of error lies in the weighing of the hydrogen. 
To diminish this error the weight of hydrogen employed was doubled; and 
since Professor Dixon and I found, when water was used to condense the 
hydrogen chloride formed in the flame, that some of the water vapour was 
decomposed by the free chlorine, I avoided this by burning a jet of chlorine 
in dry hydrogen, condensing the hydrogen chloride as it was formed in a 
tube dipped into liquid air. In some of the experiments the hydrogen 
chloride formed has been weighed. My experiments (concluded in 1907) 
agree closely with the results previously obtained in 1905. The method 
employed was briefly as follows:—

Hydrogen, made by the electrolysis of barium hydrate solution, and dried 
by potash and phosphorous pentoxide, was occluded, and weighed in 
palladium contained in a boro-silicate glass bulb. The chlorine, prepared 
by electrolysing fused silver chloride in a Jena glass vessel, was weighed as a 
liquid in a thick-walled boro-silicate glass bulb. Two ground joints attached 
these bulbs to a quartz combustion vessel, which was also connected with a 
vertical quartz tube, and with a steel bomb and a pump. After a thorough 
evacuation of the whole apparatus, the vertical limb of the combustion vessel 
was immersed in liquid air. Then the vacuous vessel was filled with hydrogen 
from the heated palladium bulb. Chlorine was ignited by a spark at the tip 
of a quartz jet, and continued to burn in the atmosphere of hydrogen with a 
fine needle-shaped flame. The endeavour was made so to regulate the gases 
as to maintain the flame until nearly all the chlorine weighed had been 
burnt. Then the supply of hydrogen was cut off. As the atmosphere became 
more attenuated the flame died away until, just before it went out, the 
chlorine was turned off. The hydrogen chloride, immediately after it was 
formed in the flame, was condensed as a snow-white solid by the liquid air 
surrounding the vertical limb of the combustion vessel; and a little chlorine, 
which had escaped burning, was also solidified. At the end of the com-
bustion, the residual gas was extracted by the pump and analysed; it proved 
to be practically pure hydrogen.

Then the snow-white hydrogen chloride was allowed to evaporate. By 
passing the gas through a quartz tube filled with mercury vapour, the chlorine 
it contained was completely removed and the purified hydrogen chloride 
passed on to a steel bomb immersed in liquid air, where it was condensed in 
six experiments and successfully weighed in three; in the other three the 
bomb leaked. In two other experiments the gas was absorbed by water and 
weighed as aqueous acid. The weights of hydrogen and chlorine burnt were
On the Atomic Weight of Chlorine.

obtained by subtracting from the total weight of each used the weight of hydrogen extracted by the pump and the weight of chlorine caught by mercury vapour respectively.

The balance was specially made for this work by Oertling; even under the load of the steel bomb, weighing over 1000 grammes, it gave very reliable readings. Each piece of apparatus weighed was tared with another of the same material and of very nearly equal volume and weight, and the small weights used in the weighings were reduced to a vacuum standard.

Below are set out the corrected weights of hydrogen and chlorine burnt in eight experiments, and the weights of hydrogen chloride caught in five:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1 2.152</td>
<td>75.502</td>
<td>72.648</td>
<td>35.196</td>
<td>35.196</td>
</tr>
<tr>
<td>2 2.0387</td>
<td>71.7504</td>
<td>75.7880</td>
<td>35.194</td>
<td>35.194</td>
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<tr>
<td>3 1.7762</td>
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<td>35.188</td>
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<tr>
<td>4 1.935</td>
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<td>72.1565</td>
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<tr>
<td>5 1.6469</td>
<td>57.9671</td>
<td>—</td>
<td>35.198</td>
<td>35.198</td>
</tr>
<tr>
<td>6 2.1016</td>
<td>73.9662</td>
<td>—</td>
<td>35.195</td>
<td>35.195</td>
</tr>
<tr>
<td>7 1.7254</td>
<td>60.7162</td>
<td>62.4401</td>
<td>35.190</td>
<td>35.190</td>
</tr>
<tr>
<td>8 2.0855</td>
<td>73.4901</td>
<td>75.5850</td>
<td>35.192</td>
<td>35.192</td>
</tr>
</tbody>
</table>

Mean............. 35.194±0.0008 35.193±0.0009

If the atomic weight of hydrogen be taken as 1.00762, the mean values for the atomic weight of chlorine, calculated from the numbers in the table above, are 35.462±0.0008 and 35.461±0.0009.

Dixon and Edgar, burning hydrogen in chlorine, found the equivalent of chlorine to be 35.463±0.0019 from their nine experiments.

The concordance of the two sets of experiments is thus exceedingly close, and the number 35.462 may be taken as representing the result of the whole work.

On the other hand Noyes and Weber,* by passing a known weight of hydrogen over weighed potassium chlorplatinate, noting the loss in weight of the salt, and condensing and weighing in water the hydrogen chloride formed, have recently obtained for the atomic weight of chlorine the mean number 35.452±0.0008 (H = 1.00762).

In view of the promised recalculiation of the atomic weights by the International Committee this year, I have not attempted to correlate my results with the recent determinations of silver, nitrogen, and chlorine.