Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Evidence for the Formation of Active Hydrogen

THE study of active hydrogen made by J. L. Binder, E. A. Filby and A. C. Grubb¹ showed no evidence for the formation of silicon hydride as proposed by E. Hiedemann². In a special investigation, A. B. Van Cleave and A. C. Grubb³ confirmed and extended this work and found no evidence for either silicon hydride or atomic hydrogen. Further work by A. B. Van Cleave has shown that this active hydrogen has properties that do not point to atomic hydrogen as proposed by some investigators. With plastic sulphur mounted in a reaction chamber, 20 centimetres from the discharge, there is a definite relation existing between voltage and pressure for the activation of hydrogen. For the region investigated, 10 mm. to 80 mm., the voltage necessary to activate the hydrogen increased with the pressure but not directly proportional to it. Above 80 mm. pressure no active gas was formed and a further increase in voltage had no effect in producing the active hydrogen. At the higher pressure the active constituent apparently decayed before reaching the sulphur. This same general relation was obtained for other tubes, but the maximum pressure at which activity is shown is related to the dimensions of the tube and to the distance of the sulphur from the discharge. It is possible to obtain positive or negative results at will with a shift of five volts on the primary of the transformer. Pure metallic sulphides mounted in place of the plastic sulphur are reduced if the heat of formation of the sulphide is not more than 23,000 calories per mole.

When the tube is operated at 40–80 mm. pressure, a faint afterglow appears in the reaction chamber. This afterglow was investigated with a Hilger spectrograph. The plates showed two prominent lines in the region λ 4634 and λ 4582 and three faint lines in the region λ 4205, λ 4354 and λ 4674. A continuous spectrum shows in the region between H_β and H_γ , but no spectrum appears in the red region. In a study using an uncoated discharge tube, it was found by a determination of the rate of decay that the reaction follows the first order equation. The active constituent decays to half value in one fifth of a second. The same tube operated under identical conditions, but coated with syrupy phosphoric acid, gave one third less active hydrogen than formerly. This is the opposite of what one would expect if atomic hydrogen were present. Binder, Filby and Grubb found from 0.001 per cent to 0.025 per cent of active constituent. The quantity depended upon the velocity of the hydrogen and the distance of the sulphur from the discharge. The values obtained by A. B. Van Cleave, using a different method of determination and different tubes, fall within this range.

A. C. Grubb⁴, and Y. Venkataramaiah⁵, have shown that a small amount of active hydrogen is produced when sulphuric acid is electrolysed using a high cathode current density. Thus previous work points to a small percentage of constituent in hydrogen that has some influence upon its activity. The values

obtained by Binder, Filby and Grubb, and by Van Cleave and Grubb, approach the order of one part in 4,000, which is about the proportion of heavy isotope, H^2 , in hydrogen. G. N. Lewis states⁶ regarding the isotope, "I believe that it will be so different from common hydrogen that it will be regarded almost as a new element".

This relation is being investigated further by using hydrogen from heavy water. Details of this work will be published in a subsequent paper. We wish to express our appreciation to the National Research Council of Canada for aid during the course of this investigation.

A. B. VAN CLEAVE.
A. C. GRUBB.

Chemistry Department,
University of Saskatchewan.

¹ *Can. J. Research*, **4**, 339; 1931.

² *Z. phys. Chem.*, **153A**, 210; 1931; and **164**, 20; 1933.

³ *J. Phys. Chem.*, **36**, 2817; 1932.

⁴ *NATURE*, **111**, 671, May 19, 1923.

⁵ *NATURE*, **112**, 57, July 14, 1923.

⁶ *J. Amer. Chem. Soc.*, **55**, 1297; 1933.

Carbon Dioxide from the Soil and Plant Assimilation

THE rôle of carbon dioxide formed as the result of biological decomposition of organic matter in the soil has long been a subject of controversy among scientific workers, one school of thought holding the view that it facilitates increased assimilation, and the other that it has no beneficial effect on plant life¹. There is also difference of opinion as to whether the increased concentration of carbon dioxide observed around the growing plant is the result of oxidation changes in the soil or merely plant respiration. The position is still obscure because (a) no systematic experiments would, so far, appear to have been carried out, growing plants in the absence of atmospheric carbon dioxide, and (b) the carbon and oxygen relations between the soil, the plant and the atmosphere have not yet been studied collectively, so that it is not possible to define, at any particular stage, the extent to which the plant is indebted to the atmosphere or the soil for the carbon dioxide assimilated by it.

With the view of throwing some light on the above, barley (Plumage Archer) was grown in small pots made up with soil and farmyard manure. One set of plants was maintained in the open as control while others were kept under big glass jars: through one set of the latter, ordinary air was drawn at a gentle rate, while through the other, air free from carbon dioxide was drawn at the same rate. It was observed that the plants grew equally well in all the cases: at the end of one month no striking difference could be observed between the weights of plants grown under different conditions.

Condition under which the plant was grown	Total No. of plants	Average weight per plant in mgm.	
		Fresh	Dry
In open air (control)	36	298.9	33.3
Under glass (ordinary air)	28	319.3	32.7
Under glass (CO ₂ -free air)	27	311.5	32.9

The above observations would suggest that, at any rate in the early stages of its life, the plant draws the bulk of its carbon dioxide requirements from the soil and manure and not from the atmosphere as is generally believed.

A further observation of interest is that the