Permeability of Metals to Hydrogen

It is well known that all the common metals are permeable to hydrogen at high temperatures. The accompanying table brings out the rather remarkable fact that, at 1,000°C., the permeability of the metals for which data are available only varies by a factor of about 10.

RATE OF DIFFUSION OF HYDROGEN IN C.C. PER CM². PER. SEC. AT 760 MM. PRESSURE FOR 1 MM. THICKNESS OF METAL.

Metal	1,000° C.	500° C.	0° C.
Iron	1×10^{-3}	1×10^{-4}	6×10^{-6}
Nickel	2×10^{-3}	3×10^{-5}	1×10^{-11}
Molybdenum	4×10^{-3}	5×10^{-5}	2×10^{-14}
Platinum	1×10^{-4}	1×10^{-5}	5×10^{-15}
Copper	1×10^{-4}	1×10^{-5}	4×10^{-15}
Aluminium	—	2×10^{-7}	2×10^{-23}

Since, however, the temperature coefficient of diffusion varies considerably for the different metals, the rates of diffusion at low temperatures are very different. In the table the rates of diffusion at 0°C.

have been calculated by means of the usual diffusion equation, and it will be seen that the rates for copper and platinum, for example, are now 10^9 times less than that for iron.

Iron is, in fact, by far the most permeable of these metals at room temperature. Apparatus for work at high pressures is usually made of steel to provide the necessary strength. The diffusion of hydrogen cannot be greatly reduced by increasing the thickness, since the rate of diffusion only varies directly as the thickness. A far more effective method of avoiding trouble from this cause would appear to be to line the steel vessel with a thin layer of one of the less permeable metals, such as copper or nickel. Provided this is free from porosity, 1 mm. of copper would be as effective as 5 miles of steel, and 1 mm. of aluminium would be better than 10^{13} miles of palladium!

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Points from Foregoing Letters

PHOTOMICROGRAPHS of transverse sections of *Ceanothus dentatus* and *Myrthus communis*, showing the formation of cambium after treatment of cuttings with growth substance (alpha-naphthalene acetic acid) are submitted by Dr. M. A. H. Tincker. Similar stimulation of growth and formation of roots was observed in cuttings of *Viburnum Carlesii* after treatment with beta-indolyl acetic acid. The author suggests that the natural seasonal excitation of the cambium may result from the downward movement of similar substances formed in young leaves.

The presence of beta-carotene (a substance related to vitamin A) in the wood oil extracted from *Acacia acuminata*, a tree of Western Australia, is reported by Dr. V. M. Trikojus and Prof. J. C. Drummond.

By feeding a rat with olive oil to which radioactive phosphate had been added, and afterwards analysing its tissues, a group of investigators from the University of Palermo have found a large percentage of the radioactive phosphorus in the phospholipids (both the 'lecithin' and the 'cephalin' type) of the liver and of the gut. Kidneys also showed a small but definite activity, while the heart, spleen and skeletal muscle showed practically none.

Prof. C. N. H. Long and Dr. S. Zuckerman bring forward various considerations which lead them to the view that cyclical alterations in adrenal cortical activity still persist in spayed monkeys and are responsible for the periodic bleeding that can be induced by a constant threshold dose of œstrone injected daily.

Dr. S. J. Folley and Dr. S. K. Kon find that relatively high doses of the sex hormone, progesterone, when given to the lactating rat, do not inhibit lactation as judged by the rate of growth of sucklings. This, they consider, supports Anselmino's view that the inhibitor of lactation is a different hormone.

Prof. D. H. Bangham and Prof. F. J. Lewis show that whilst water adheres but weakly to the mesophyll cell walls in the leaf, organic liquids adhere strongly and rapidly fill the interspaces, under the influence of capillarity. On the other hand, water wets

comparatively easily the outer surfaces of the fine vascular bundles of the leaf. It is concluded that the water vapour of transpiration is not evaporated from a film of liquid water, however thin, on the outer surface of the mesophyll cells.

A new method of studying the freezing points of soil and plant material is described by L. P. Alexander and T. M. Shaw and exemplified by results obtained with peas and sweet potatoes. It depends upon the great change in dielectric constant of water when it freezes, and is applicable whenever the dielectric constants of the materials present, other than water, do not change significantly over the temperature range studied.

By irradiating cupric oxide with fast neutrons from radium-beryllium, Dr. E. A. Oeser and J. L. Tuck have obtained a radioactive body of half-life 160 min. This precipitates with nickel and the authors consider it to be radioactive nickel of mass 63 or 65, produced from copper by capture of a neutron and expulsion of a proton. The authors direct attention to the large number of different half-life periods reported for radioactive copper isotopes and suggest their probable origin.

J. Rotblat has confirmed the existence of the 11 min. radio-isotope of copper, the production of which by fast neutrons was reported by Heyn. He has also found that fast neutrons give in silver the isotope of 25 ± 3 min., probably ^{106}Ag . In both cases the new product is formed with emission of a nuclear neutron. An elementary process of this type leads to the appearance of two relatively slow neutrons which are more efficient than the primary neutrons in producing artificial radioactivity. This effect may account for the increase of radioactivity produced by fast neutrons after passage through some absorbing substances.

It is suggested by Prof. J. Kaplan that the variation in the relative intensity of bands emitted by the neutral molecule ion and those emitted by the neutral molecule in the auroral afterglow, might be used as the basis for a method of obtaining pressures in the earth's upper atmosphere, by comparing this ratio in actual auroras and in the auroral afterglow.