might be accepted as conclusive, and hence, in determining the weight of a volume of water at any given temperature, the Standards Department have been advised to adopt a mean result from several selected determinations, as those of Despretz, Kopp, and Pierre.

In many technical works, measurements of gas are erroneously referred to the temperature of 60° F., and not to the legal temperature of 62° F., at which temperature alone the standard foot contains 12 inches; the standard gallon 10 lbs. weight of water; and the standard pound 7000 grains. It would appear that an error originally committed in certain hydrometer tables in taking 60° F. instead of 62° F., has been followed by many chemical authorities.

The weight of a cubic foot of ordinary air has been still taken by the Standards Department after the determinations of Regnault, as corrected by Moritz, Broch, and Agamemnone. The amount of carbonic acid present in ordinary air has been taken, after the inquiries of Parkes and Angus-Smith, at 6 volumes in every 10,000 volumes of air. If double the quantity, 12 volumes, is present, as is sometimes the case in common rooms, it will make a difference of about 0·18 grain in the weight of the cubic foot of air. Ordinary air is still taken, after Regnault, as being two-thirds saturated with moisture.

In calculating the true weight of any given volume of air or of gas we may, of course, on very rare occasions have to allow for the accelerative effect of the force of gravity at the latitude of the place where the air or gas is weighed, as well as for the height of the place above sea-level. The normal latitude adopted in all such experiments is that of 45° at sea-level.

For instance, the weight in grains of a cubic foot of ordinary air ($t = 62°$ F., B = 30 in.) at London (lat. = 51° 29′ 53″), at Edinburgh (lat. = 55° 57′ 20″), and at Dublin (lat. = 53° 20′ 38″), has been taken as follows:—

	Dry air.	Air two-thirds saturated.	Moist air saturation = 1.
	Gr.	*Gr.*	*Gr.*
Edinburgh	534·42 ...	531·92 ...	530·68
Dublin	534·30 ...	531·81 ...	530·56
London	534·21 ...	531·72 ...	530·48

From time to time, on the application of local authorities, suggestions are issued by the Board of Trade as to the best modes of testing the weights, measures, and measuring instruments used for commercial purposes. In this country the local inspectors are not bound to follow official instructions as they are in other countries, but are free to carry out their technical work in such a way as the Justices and Town Councils may approve. It is therefore only by the issue of such official suggestions that uniformity of local practice can be at all reached, and some amount of co-ordination and local effectiveness thereby secured. It is perhaps to be regretted that there is in this country no central authority like the Normal Aichungs Kommission of Germany or Austria to give force and life to the whole local system; not that we would have the local officers in this country drilled to the dull sameness of official uniformity in the way they are drilled by some Continental Governments, but the absence of a proper scientific training by our local inspectors often leads to complaints from traders and manufacturers. By these official suggestions the Board of Trade endeavour, therefore, to educate local officers in their technical work and to keep them so far in touch with modern progress.

The present Report contains a paper on the testing of weighing-machines, which should be of really practical use to the local officers, for it is the first time that any instructions have been published as to the mode of testing such machines.

Amongst other appendixes to this Report we find papers relating to the well-known model apparatus, designed by Sir F. Abel, for testing the flashing-point of petroleum; abstracts of returns from local officers; notes on the sale of coal by weight and the sale of intoxicants by measure—with reference to which it would appear that there is more petty fraud than ever amongst traders; and a note on the average current weight of the sovereign. In the latter note reference is made to a number of weighings of gold coin, which have been recently made at the leading Banks in London. The results of these weighings show that most of the gold coinage in circulation has really ceased to be legal tender as to weight. Nearly all the coins which were weighed were found to be slightly below the least current weight allowed by the Coinage Act. If the present law, which requires receivers of light gold coins to cut or deface them, were really obeyed, then it would appear from this note that six sovereigns out of every seven ought strictly to be cut or defaced. This seems to be a worse state of things than when Prof. Jevons made his well-known report on the metallic currency of the United Kingdom in 1868.

THE GERMAN METEOROLOGICAL OFFICE.

A HISTORY of the Royal Prussian Meteorological Institute from the time of its establishment in 1847 until its re-organisation in 1885, by Dr. G. Hellmann, has just been published in the year-book of the Institution, "Ergebnisse der Meteorologischen Beobachtungen im Jahre 1885" (Berlin, 1887, 246 pages, large 4to, with plates). Dr. Hellmann is well-known to students of meteorology by many very valuable articles, and especially by his laborious compilation of a "Repertorium der Deutschen Meteorologie," containing a list of the articles, inventions, and observations in the domain of Meteorology and Terrestrial Magnetism in Germany from the earliest times down to the year 1881 (Leipzig, 1883, 995 pages, large 8vo). The kingdom of Prussia was relatively late in organising a regular system of observations, Baden and Bavaria in Southern Germany having established well-appointed services before the end of the last century; and Würtemberg followed with its system in 1821-2. The want of trustworthy data for Northern Germany was much felt by Baron A. von Humboldt at the time of the construction of his first isothermal charts in 1817, and the establishment of the service in Prussia was due to the urgent representations which he made to the present Emperor. In 1847 a system of 25-30 stations was established under Dr. Mahlmann, and observations were taken at the hours of 6, 2, and 10; these hours have been generally adhered to both in Germany and Austria down to the present time. Before commencing operations, all the stations were duly inspected, and suitable observers selected, mostly from teachers in the upper schools. While neither instruments nor remuneration are provided for such observers in this country, in the Prussian system an annual allowance, varying from about £7 10*s.* upwards, according to circumstances, is made to many of the observers, together with an outfit of instruments. The result of these arrangements has been that probably in no other system upon the globe have so many useful works been published by the various observers, upon whom generally devolved the task of working up their own observations. Dr. Mahlmann having died suddenly on one of his tours of inspection, his work was taken up in April 1849 by the late eminent Prof. H. W. Dove, of the University of Berlin, and his first care was to revise the observations hitherto taken and to publish them in a first Report of the Observations taken in 1848-9. The publication of this Report induced several other states to join the Prussian system, many of the observers now taking up the work without remuneration, and this active co-operation enabled Dove to publish for 1855, and for subsequent years, a summary of observations for each month of the year for Northern Germany, and in 1858 a first sketch of the climatological conditions based upon ten years' observations. Prior to this publication these

conditions were almost unknown for Prussia. Some of the stations were inspected yearly by Dove, but strange to say, it is stated that not a single Report of these inspections is to be found in the archives of the Institute. Among the numerous treatises by Prof. Dove, that best known is his work on the "Law of Storms," which was translated and adopted in this country. After Dove's death, in 1879, the Institute introduced the French measures in its publications, and adopted generally the recommendations of the various International Congresses, to which innovations Dove himself had always been averse, and instruments with new scales were necessarily supplied to the stations. In 1882 Dr. Hellmann was intrusted with the *ad interim* direction of the Institute, and many additional stations, especially for rainfall, were added to those which already existed, and finally (in 1885) the Institute was placed under the able superintendence of Dr. W. von Bezold, formerly director of the Bavarian system, with Drs. Hellmann, Assmann (also Director of the Magdeburg Observatory), Kremser, and Wagner, as principal assistants. The first volume of the new office has just appeared, and contains the observations at 271 stations during the year 1885 (246 pages, 4to, and 6 litho. tables), and also lists of all observations made since 1847. The stations are still very unequally distributed over the Empire, and no doubt improvements will be made in this respect, from time to time. It is plainly shown from the tables that while an open country position is most suitable *meteorologically*, yet for *duration* of the observations the large towns are preferable. These observations formerly appeared in the "Preussische Statistik," and in the publication of the Deutsche Seewarte, but will henceforward form an independent work. It is proposed in future to issue the tabular portion in quarterly volumes, and to publish pamphlets at irregular intervals under the title of "Abtheilungen," containing papers and discussions of a general nature. The Deutsche Seewarte at Hamburg is an independent Institution, dealing chiefly with maritime meteorology and weather telegraphy. J. S. HARDING.

THE HEIGHT OF SUMMER CLOUDS.

A KNOWLEDGE of the heights and movements of the clouds is of much interest to science, and of especial importance in the prediction of weather; the subject has therefore received much attention during recent years from meteorologists, chiefly in this country and in Sweden. In the last published Report of the Meteorological Council for 1885-86 will be found an account of the steps taken by that body to obtain cloud-photographs; and in the *Meteorologische Zeitschrift* for March last, MM. Ekholm and Hagström have published an interesting summary of the results of observations made at Upsala during the summers of 1884-85. They determined the parallax of the clouds by angular measurements made from two stations at the extremities of a base of convenient length, and having telephonic connexion. The instruments used were altazimuths, constructed under the direction of Prof. Mohn, specially for measuring the parallax of the aurora borealis. A full description of these instruments and of the calculations will be found in the *Acta Reg. Soc. Sc. Ups.* 1884. The results now in question are based upon nearly 1500 measurements of *heights*; the *motions* will form the subject of a future paper. It was found that clouds are formed at all levels, but that they occur most frequently at certain elevations or stages. The following are, approximately, the mean heights, in feet, of the principal forms:—Stratus, 2000; nimbus, 5000; cumulus (base), 4500, (summit) 6000; cumulo-stratus (base), 4600; "false-cirrus" (a form which often accompanies the cumulo-stratus), 12,800; cirro-cumulus, 21,000; cirrus, 29,000 (the highest being 41,000). The maximum of cloud-frequency was found to be at levels of 2300 and 5500 feet. Generally speaking, all the forms of cloud have a tendency to rise during the course of the day; the change, excepting for the cumulus-form, amounting to nearly 6500 feet. In the morning, when the cirrus clouds are at their lowest level, the frequency of their lowest forms—the cirro-cumulus—is greatest; and in the evening, when the height of the cirrus is greatest, the frequency of its highest forms—the cirro-stratus—is also greatest. With regard to the connexion between the character of the weather and the height of the clouds, the heights of the bases of the cumulus are nearly constant in all conditions. The summits, however, are lowest in the vicinity of a barometric maximum; they increase in the region of a depression, and attain their greatest height in thunderstorms, the thickness of the cumulo-stratus stretching sometimes for several miles. The highest forms of clouds appear to float at their lowest levels in the region of a depression. The forms of clouds are identical in all parts of the world, as has been shown in papers lately read by the Hon. R. Abercromby before the English and Scottish Meteorological Societies.

IVAN POLYAKOFF

RUSSIA has lost one of her most promising men of science in Ivan Polyakoff, who died lately at St. Petersburg, from hepatic disease, at the age of about forty. He was born in the small village of Transbaikalia, on the Argun, of Cossack parents, descendants from the earlier settlers of Siberia, and received his first education in a military school for sons of soldiers and Cossacks at Irkutsk—a very limited education indeed. As his parents were poor, and life in his native village offered no attractions, he accepted the position of teacher at the same school where he had been educated. Zoology and botany became the sciences of his choice A large park belonging to the Governor, close by the military school, peopled with a variety of birds and insects, became the first field of his researches. As the spring came, he would spend the day in the garden, sometimes extending his excursions to the neighbourhood of Irkutsk, where so much is to be learned. He wrote down his observations, and published them in the *Irkutsk Gazette*. From the very first lines of his description one is struck by a remarkable feature of Polyakoff's mind—a feature which is to be found in all his later writings, and which cannot but be highly appreciated by a true naturalist: it is the simplicity of his conception of the animal world; I should say his intimacy, his familiarity, with every bird or animal he describes. He *understood* them. One must be born in a lonely Siberian village on the confines of the civilized world, at the border of the uninhabited Gobi steppe—the Argun is such a border—to be always in so close a contact with Nature.

Early in 1866 I was going to make a great journey to find out the long-searched-for route from the Lena gold-washings to the steppes of Transbaikalia. A topographer accompanied the Expedition; I undertook the geological exploration; for the botanical and zoological I invited Polyakoff to join us. We crossed the region from the Lena to Tchita, and thus Polyakoff and I were able to make a section of the backbone of the Asiatic continent, with its high and lower plateaus, their border-ridges, and the Alpine regions which fringe them. A zoologist like Polyakoff was thus enabled to obtain an insight into the whole of the Siberian fauna, as dependent upon orographical features. His descriptions of the fauna and flora of the region, especially with regard to the dependence of animals and plants upon their surroundings and their mutual interdependence—he excelled in that kind of research—are a most valuable contribution to the geographical zoology and botany of a wide region. His