

It will be seen that the 1st string is thicker, and the 3rd thinner, and the 4th much lighter than the theoretical values. Therefore the tension of the 1st string would be greater, and that of the 3rd and 4th strings less than they should be in relation to that of the 2nd string. The greater flexural rigidity of the 4th string will have a small effect in the direction of making the vibrations quicker, and therefore of making the tension required less.

By means of a mechanical contrivance I found the weights necessary to deflect the strings to the same amount when the violin was in tune. The results agreed with the tensions which the sizes of the strings showed they would require to give fifths.

A violin strung with strings of the theoretical size was very unsatisfactory in tone.

The explanation of this departure of the sizes of the strings which long experience has shown to be practically most suitable, from the values they should have from theory, lies probably in the circumstance that the height of the bridge is different for the different strings. It is obvious, where the bridge is high, there is a greater downward pressure. By this modification of the sizes of the strings there is not the greater pressure on the 4th string side of the bridge, which would otherwise be the case. On the contrary, the pressure is less, which may assist the setting of the belly into vibration. There is also the circumstance that the strings which go over a high part of the bridge stand farther from the finger-board, and have therefore to be pressed through a greater distance, which would require more force than is required for the other strings, if the tension were not less.

II. "Note on the Atomic Weight of Glucinum or Beryllium."

By J. EMERSON REYNOLDS, M.D., F.R.S. Received May 8, 1883.

In the course of a paper by Professor Humpidge on the above subject, recently read before the Society,* the author seeks to decide between the atomic weight 9.2 for beryllium, resulting from my comparison of the atomic heat of the element with that of silver and aluminium,† and the value 13.8, arrived at by MM. Nilson and Pettersson by determination of specific heat.‡ The difference between the two possible atomic weights is so small, and the difficulties met with in

* Read April 12, 1883.

† "Chemical News," vol. xxxv, p. 124, and vol. xlii, p. 273. A slight modification of the method of comparison adopted is described in detail in the writer's "Experimental Chemistry" (Longmans), Part I, p. 59.

‡ "Proc. Roy. Soc.," vol. 31, p. 37.

attempting to prepare even a few decigrams of beryllium are so great, that both sets of experiments have been objected to on the ground, amongst others, that the metal employed was in all cases impure. My specimen admittedly contained a minute quantity of platinum, and the proportion of known impurity in one of MM. Nilson and Pettersson's specimens reached 13 per cent. Unfortunately, Professor Humpidge's metal, though claimed to be the purest yet prepared, is shown by analysis to be rather less pure than one of the specimens employed by Nilson and Pettersson, hence the experiments lately made known to the Society do not carry the inquiry beyond the point previously reached, save in one noteworthy particular, namely, that there appears to be a considerable, though irregular, rise in specific heat of the element as the proportion of impurity diminishes; but the value is still much below that required for the atomic weight 9.2. Thus for a specimen of beryllium which contained 13 per cent. of *known* impurity Nilson and Pettersson obtained the specific heat 0.4084 between 0° and 100° C., and for a less impure specimen 0.425; while Professor Humpidge, in one of his experiments with a material that contained 6 per cent. of impurity, found the specific heat to be nearly 0.45 (0.4497). In all these cases corrections were applied which were believed to eliminate the effects due to the impurities known to be present—in part mechanically mixed with the metal and partly alloyed with it.

These results all tend in one direction, that is to say, to apparent gain in specific heat with increased purity of material, and in so far they approach the still higher value obtained in my old experiments. But even if the latter had not been made, the apparent rise in specific heat shown by the other determinations, would suggest the necessity for appeal to data afforded by beryllium of undoubted purity. In order that further experiments should now be considered decisive, the metal should not only be pure, but in the form of a homogeneous mass obtained by fusion, as the specimen I used was an apparently uncrystalline product of fusion, while the metal employed by Nilson and Pettersson chiefly consisted of "aggregations of little prismatic needles," mixed with the oxide.

The most promising source of pure beryllium is the double fluoride of the element and potassium, but I have not hitherto succeeded in making the product of reduction form a button of metal.

Professor Hartley has very recently made known some highly interesting spectroscopic evidence* affecting the position of beryllium amongst the metals, and so directly bearing on the question of its valence that I may be permitted to refer to the results in this place.

If the atomic weight of beryllium be 13.8, the element is a triad and the formula of its oxide must be Be_2O_3 . The latter therefore resembles

* In a communication read before the Chemical Society, April 19, 1883.

alumina in being a sesquioxide, but is at once distinguished as it does not afford an alum-like double sulphate as do alumina and its homologues, and has comparatively little in common with that group, save the tendency to form highly basic salts. Nilson and Pettersson,* admitting this, maintain that beryllium is a leading member of another group of triads, which includes the rare earth-metals scandium, yttrium, lanthanum, didymium, terbium, erbium, &c. The recent spectroscopic evidence above referred to is opposed to this contention, as the spectrum of beryllium is stated to be wholly unlike the spectra afforded by the rare earth-metals with which it is classed in the memoir above cited. If, then, beryllium does not find a place in the two known families of metallic triads, or pseudo-triads, it must stand alone; and in any case as a triad it is outside Mendeleef's classification. But if the atomic weight of beryllium be 9.2, according to my result, the metal is a diad and the symbol for its oxide is BeO . It is, therefore, the first member of Mendeleef's second series of elements. This position is quite in accordance with the spectroscopic evidence obtained by Professor Hartley, from which he concludes that "beryllium is the first member of a diad series of elements, of which in all probability calcium, strontium, and barium are homologues."

III. "The Effects of Temperature on the Electromotive Force and Resistance of Batteries. II." By WILLIAM HENRY PREECE, F.R.S. Received May 21, 1883.

In the discussion on my previous paper read on February 22, 1883, it was suggested that I should continue the observations on the influence of temperature to the case of secondary batteries. I am indebted to Mr. Tribe for one of his cells made so as to fit my apparatus, and charged at different times with solutions of various degrees of saturation.

The negative element of this cell consisted of pure peroxide of lead in the form of a plate 4 inches square carried in a grooved frame, from one end of which projected the necessary conductor. This element was placed between two plates of finely divided lead likewise 4 inches square. These were joined together, and formed the positive element of the cell. Each half of the positive plate was about a quarter of an inch distant from the negative, and all three plates were encased in a thin specially prepared fabric. The elements were contained in a leaden case, and the liquid was sulphuric acid of the strengths given in the various experiments. This cell was placed inside the cylindrical copper vessel used in the previous experiments, and precisely the same method of observation was adopted. The results are given in

* "Proc. Roy. Soc.," vol. 31, p. 50.