NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

THE NEW METHOD OF OBTAINING OXYGEN.

We gave three weeks ago a brief account of Fleitmann's method of preparing oxygen, by gently heating a solution of chloride of lime with a small quantity of peroxide of cobalt. As cheap oxygen would be of immense value in the metallurgical and other arts, and as Fleitmann's process seems to promise to enable us to obtain that gas at a rate of cost at which it would be available for technical purposes, we now add a few further details. Chloride of lime is a compound of chlorine, calcium, and oxygen; Fleitmann's process abstracts all the oxygen, leaving behind only chloride of calcium. The peroxide of cobalt employed in the process is required only in very minute quantity,—one part of the peroxide to a thousand parts of chloride of lime will usually be found sufficient,—and as the same portion of peroxide can be used over and over again, while the reaction takes place at a temperature of between 70 and 80 deg., so that the process does not involve the consumption of much fuel, the cost of obtaining oxygen by this method should but very slightly exceed the cost of the chloride of lime, which is a tolerably cheap commodity. M. Fleitmann's theory of the process is that there are several peroxides of cobalt, containing different proportions of oxygen, and that "one of these peroxides abstracts oxygen from the chloride of lime to form a higher oxide, which is then decomposed into a lower oxide and free oxygen," this alternate composition and decomposition going on continuously. Instead of adding actual peroxide of cobalt to the chloride of lime solution, it is sufficient to add a proper quantity of solution of any cobalt salt from whose solution the hydrated peroxide is precipitable by chloride of lime. The solution of chloride of lime should be a strong one, and, as we have already stated, "should be quite clear, as a thick or murky solution will froth over." M. Fleitmann's explains that "the best way of making a clear and strong solution is by first digesting one portion of chloride of lime in water, decanting the clear liquor, and then making use of it to digest another portion of chloride. In this way it is easy to get a liquor which will evolve from twenty-five to thirty times its own volume of oxygen." He adds: "On the small scale it is best to employ a capacious flask, which may be about seven-eighths filled with the solution. On a large scale, for technical purposes, a sort of steamboiler might be used, and the oxygen be so obtained under pressure, and capable of being employed as a blast." M. Fleitmann has published no statement of the cost of oxygen obtained by this method, but it would probably not exceed one half penny per cubic foot,—a price at which it would not be too costly for use in many operations in the arts requiring an intense temperature.

SILICIUM IN IRON.

It is well known that there are two states in which carbon exists in solid iron: a state of chemical combination with the iron, and a state of merely mechanical diffusion through its mass. It is also known that the carbon existing in iron in the last-mentioned state is always in the form of graphite. Dr. Phipson has just announced to the Academy of Sciences that he has discovered that silicium also may exist in cast iron either in a state of combination or in a state of diffusion merely, and that, like carbon, when merely diffused through the iron, and not in combination therewith, it is always in the graphitic form. He adds, what, if true, is of great practical importance, that upon the condition of the silicium in any given sample of cast iron depends, in a very great degree, the practicability of converting that iron into steel by the Bessemer process. He regards diffused or uncombined silicium as the least injurious, stating that while iron containing as much as three or four per cent of free silicium can be converted into excellent steel by the Bessemer method, the presence of a very much smaller quantity of combined silicium will either render the iron containing it incapable of being converted into steel by that method at all, or will cause the steel produced from such iron to be so hard and bad as to be quite incapable of being worked. He promises to publish shortly a full account of his method of determining the condition in which silicium exists in iron, with details of his experiments upon the influence of that condition upon the results of the treatment of the iron by the process referred to.

SIMPLE METHOD OF REDUCING SOME METALS.

Glucinum and zirconium, the former being the metallic base of the emerald and the latter that of the zircon and the hyacinth, are metals of which chemists know very little. They have hitherto been obtained only from very rare and costly minerals, and by reduction from their haloid salts by means of potassium. A paper in the last number of "Cosmos" suggests, however, that these two metals, and also the still less known ones, yttrium, erbium, terbium, cerium, thorinum, lanthanum, and didymium, probably exist much more abundantly than has hitherto been supposed and states that they all admit of being isolated by an exceedingly simple electrolytic method, consisting merely, in each case, in immersing in a solution of a salt of the metal which it is desired to reduce a plate of zinc and a plate of platinum, duly connected together. The metal is then gradually precipitated upon the platinum plate.

PRODUCTION OF PURE IRON FOR ELECTRO MAGNETS.

It is very important that the iron used in the construction of electro-magnets and their armatures should be as pure as possible, since the purer iron is the more strongly susceptible is it to magnetic attraction, and the more speedily it loses any magnetic power which it may have acquired by induction. Electrolysis, however, is the only method as yet known by which iron can be obtained in a state at all approching purity, and electro-deposited iron has not hitherto been obtainable cheaply enough to admit of its being used in the construction of electro-magnetic apparatus of any size. M. Becquerel has been trying to find a cheap method of obtaining such iron, and he has devised one by which he thinks that electrolytic iron could be obtained at a price at which it would not be too costly for use in the construction of telegraphic and other electro-magnetic apparatus. Into one of the branches of a large U-shaped tube he pours a solution of proto-sulphate of iron, and into the other branch a solution of chloride of sodium. He then plunges into each branch a plate of platinum, one connected with the positive and the other with the negative pole of a constant battery of three or more cells. He so regulates the intensity of the current as to keep the disengagement of hydrogen barely perceptible, and the final result of the primary and secondary actions which take place is that a double sulphate of iron and sodium is formed at the positive pole, and that oxide of iron is reduced by hydrogen at the negative pole. The reduced iron is of course deposited on the negative electrode, from which, however, in may be readily detached. It is all but absolutely pure, and is attracted by the magnet much more powerfully than the purest iron hitherto obtainable in commerce.

ALUMINA AS AN INGREDIENT OF SOAPS.

Soaps intended for toilet use ought not to contain any free alkali, seeing that free alkali exercises a corrosive action upon the skin. Soaps, however, which are perfectly neutral, containing no alkali which is not combined with the stearic or other fatty acid employed, are not nearly such powerful detergents as soaps containing an excess of alkali,—are not nearly so capable of dissolving the substances which it is the office of soap, when applied to the body to remove from the skin. Singular to say, M. Bonnamy, a manufacturing chemist resident at Saint-Germain, has found that if that very neutral substance, pure alumina, be added to completely neutral soap, the soap becomes even more powerfully detersive than the most highly alkaline soap, while remaining entirely free from corrosive properties. The alumina may be introduced into the soap in various ways, the most advantageous perhaps being the use, in the process of manufacturing the soap, of an alkaline salt of alumina, as aluminate of potash or soda, instead of free alkali. An equally good result is however obtained by mixing free alumina, in dry powder, with melted soap which has been manufactured in the ordinary way. M. Bonnamy proposes to use alumina also in various cosmetics, and especially in cold-cream, and he moreover regards it as affording an admirable base for tooth-powders, by reason of its complete neutrality, and the case with which it can be tinted by means of perfectly innocent coloring matters.

ANILINE AS A TEST FOR THE ADULTERATION OF LINEN BY COTTON.

A method of using aniline as a means of ascertaining whether or not the linen in any fabric is mixed with cotton, and, if so, in what proportion, is given by Bottger in a recent number of the "Chemisches Central Blatt." At the corners of one end of a strip of the fabric to be tested he loosens the threads so as to expose both the warp and the woof. He then dips that end of the strip in an alcoholic solution of aniline red, washes it in water until the washings are colorless, and then places it in an aqueous solution of ammonia. If any cotton is present, the ammonia will discharge the color from it without touching the color of the linen portion. The linen threads will remain of a bright rose color, but the cotton threads will become quite white.

ON SCIENTIFIC EXPERIMENTS IN BALLOONS.

BY JAMES GLAISHER, ESQ., F.R.S., ETC.

The *London Artisan* publishes a long letter by Mr. Glaisher giving the results of his numerous observations in balloons on the temperature and moisture of the atmosphere, and other matters of interest; from which paper we take the following statements:—

DECREASE OF TEMPERATURE WITH ALTITUDE.

WHEN THE SKY WAS CLOUDY.

Feet	Feet.	Deg.		Feet.
From 0 to	1,000 the decrease was	8·1 or 1 deg. on the average of		223
From 0 to	2,000	8·1		247
From 0 to	3,000	11·8		385
From 0 to	4,000	15·2		353
From 0 to	5,000	18·5		271
From 0 to	6,000	21·7		277
From 0 to	7,000	34·4		287
From 0 to	8,000	26·8		299
From 0 to	9,000	29·0		311
From 0 to	10,000	31·0		321
From 0 to	11,000	33·0		320
From 0 to	12,000	35·6		327
From 0 to	13,000	37·8		344
From 0 to	14,000	40·1		349
From 0 to	15,000	42·1		356
From 0 to	16,000	44·2		362
From 0 to	17,000	45·4		375
From 0 to	18,000	46·7		386
From 0 to	19,000	48·1		395
From 0 to	20,000	49·0		409
From 0 to	21,000	50 1		4 9
From 0 to	22,000	50·9		432
From 0 to	23,000	51·7		445

WHEN THE SKY WAS CLEAR, OR CHIEFLY CLEAR.

Feet.	Feet.	Deg.		Feet.
From 0 to	1,000 the decrease was	6·2 or 1 deg. on the average of		162
From 0 to	2,000	10 9		184
From 0 to	3,000	14 7		204
From 0 to	4 000	18·0		223
From 0 to	5 000	20 9		239
From 0 to	6,000	23·5		259
From 0 to	7,000	26·0		271
From 0 to	8,000	28·7		279
From 0 to	9,000	31·2		289
From 0 to	10,000	33·6		298
From 0 to	11,000	35·6		309
From 0 to	12 000	37·9		317
From 0 to	13,000	40·1		324
From 0 to	14,000	42·1		333
From 0 to	15,000	43·8		343
From 0 to	16,000	46·0		348
From 0 to	17,000	47·9		355
From 0 to	18,000	49·6		363
From 0 to	19 000	51·1		372
From 0 to	20,000	52·4		382
From 0 to	21,000	53·6		392
From 0 to	22,000	54·7		405
From 0 to	23,000	55·7		413
From 0 to	24,000	57·0		422
From 0 to	25,000	58·1		431
From 0 to	26,000	59·1		441
From 0 to	27,000	60·1		449
From 0 to	28,000	61·0		459
From 0 to	29 000	61 8		469
From 0 to	30,000	62.3		482

These results, showing the whole decrease of temperature from the ground to 30,000 feet, differ greatly, as just mentioned, from those with a cloudy sky.

The numbers in the last column, showing the average increase of hight for a decline of 1° of temperature from the ground, to that elevation, are all smaller than those with a cloudy sky at the same elevation. Each result is based upon at least seven experiments, taken at different times of the year, and up to this hight considerable confidence may be placed in the results; they show that a change takes place in the first 1,000 feet of 1° on an average in 162 feet, increasing to about 300 at 10,000 feet. In the year 1862 this space of 300 feet was at 14,000 feet high, and in 1863 at 12,000 feet. Therefore, the change of temperature has been less in 1863 than those in 1862, and less in 1864 than in 1863, but the experiments have all been taken at different times of the year.

Without exception, the fall of 1° has always taken place in the smallest space when near the earth.

MOISTURE OF THE ATMOSPHERE.

After giving long tables of his observations, Mr. Glaisher thus sums up the results:—

The law of moisture shown in a cloudy day is a slight increase from the earth to the hight of 3,000 feet, and then a slight decrease to 6,000 feet, the degree of humidity being at this elevation nearly of the same value as on the ground; from 6,000 feet to 7,000