Part ii. is devoted exclusively to mules and mule breeding, and is replete with valuable and exhaustive information on these subjects. The authors strenuously deny the existence of fertility in either the male or female mule, affirming that abnormal lactation not unfrequently occurs in female mules, when milk is secreted in great abundance, and that the foals which they are observed to be suckling are in reality the foals of other animals which the mules have adopted. With regard to the oft-quoted instance of a mule in the Acclimitisation Gardens in Paris, which has produced foals when mated both with the horse and ass, the writers doubt whether the animal is a mule, and assume that she is an ordinary mare, whose female parent was influenced by a first alliance, as is so often the case in dogs and other animals. If their contention is correct, the mule may still aptly be described as "an animal of no ancestry and with no hope of posterity."

The writers are enthusiastic, nay even fulsome in their praise of this hybrid, and bitterly lament the lack of appreciation in which it is held in Great Britain as compared with America and some European States. "In endurance," say the authors, "capability of hard labour, economy in keep, longevity, and freedom from disease, mules far surpass horses." Into so controversial a matter this is not the place to enter, and we must content ourselves with the belief that so plain and oftentimes so ugly an animal as the mule will never supplant to any great extent, in this country at least, the beautiful and graceful varieties of the horse of which Englishmen are naturally so proud.

To any of our readers who are interested in the subject of mule breeding, this work may be heartily recommended; and, in conclusion, we feel bound to compliment in the highest terms all who have been instrumental in its production. W. F. G.

The Moon. By T. Gwyn Elger, F.R.A.S. Pp. 174. (London: George Philip and Son, 1895.)

IN this latest work on the moon, from the pen of one of the foremost of British selenographers, the most noteworthy feature is the excellent chart, eighteen inches in diameter; this is given in four quadrants, but it can also be obtained complete and separately. All the named formations are distinctly shown, and the names of the more important are very clearly printed on the map itself. The greater part of the text resolves itself into a descriptive index to the map; but though this appears in rather stereotyped fashion, it embodies a good deal of information which has been gleaned by the author during many years of observation. An introduction of forty pages deals with lunar phenomena generally, and includes numerous hints which will be of use to the observer. Mr. Elger objects most emphatically to our satellite being spoken of as a changeless world, and justifies his position by stating that volcanic outbursts, producing mountains as large as the Monte Nuovo, might occur in many parts of the moon without the world being any the wiser. Though possessing little of novelty, and not appealing to the general reader, the book and map together constitute a handy work of reference which observers of experience, as well as beginners, will be glad to have by them. A few details as to the phenomena to be observed during eclipses of the moon, might have been included with advantage.

Algebra. Part i. By M. H. Senior. (Oldham: D. W. Bardsley.)

KINDERGARTEN methods of teaching are now applied to most subjects. In this small book of fifty pages, the author endeavours to make algebra interesting to young students by associating the abstract symbols with concrete objects. The novel features of the book are the explanation of brackets, the exercises on factors, short methods of multiplication and division, the elucidation of signs, and the numerous practical examples.

LETTERS TO THE EDITOR.

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Argon and Dissociation.

THE discovery of the new substance argon, by Lord Rayleigh, has given rise to a difficulty which, it is thought by some, shows that the periodic law of Mendelejeff has not that generality which has been attached to it by chemists during the last few years.

According to Lord Rayleigh's determination, the density of argon is 19·9 (H=1), making the atomic weight 39·8, as the molecules are shown to have no internal energy of the same order as their energy of translation, and hence to be monatomic. Argon with this atomic weight cannot possibly find a place in the natural classification. If its atomic weight were less than 39·1 (the atomic weight of potassium), argon would fall in the VIIIth or interperiodic group in Lothar Meyer's table; and its properties, so far as they have been investigated, would harmonise with this position.

The determination of the vapour density of iodine by V. Meyer, Crafts and Meier, and others, has shown that at temperatures below 1000° C. the gas consists of diatomic molecules, while above this dissociation takes place, and above 1500° C. we have the dissociation complete, and the molecules are monatomic.

Why, then, cannot we have a similar behaviour in the case of argon?

If argon at low temperatures (somewhere near its critical point) consisted of diatomic molecules, which dissociate as the temperature rises, the difficulty of the position of argon would be removed. Thus, suppose at the temperature at which 19·9 was determined as the density of argon, the dissociation has proceeded so far that 5 per cent. of the molecules remain diatomic; the average molecular weight would be 39·8, but we should have two kinds of molecules, monatomic and diatomic, and the atomic weight under these supposed conditions would be

$$\frac{39{\cdot}8 \times 100}{105} = 37{\cdot}9.$$

The ratio of the specific heats, at constant pressure and constant volume, taking 1·4 for this ratio for a gas with diatomic molecules, and $\frac{5}{3}$ for a gas with monatomic molecules, would be for argon, on the above supposition,

$$\frac{95 \times \frac{5}{3} + 5 \times 1{\cdot}4}{100} = 1{\cdot}65.$$

This value agrees very well with the values (1·16—1·65) determined for argon.

This explanation reconciles argon with the natural classification; and as yet no facts have been published in opposition to it.

If this hypothesis be true it could be easily verified, for at temperatures, not much higher than that at which the vapour density determinations were made, the dissociation would be complete; and hence the vapour density in agreement with a molecular weight about 38; and also at lower temperatures than that at which the vapour density has been determined the gas would not obey Charles' law; for the recombination of the single atoms to form diatomic molecules, and possibly molecules containing a greater number of atoms, would cause a contraction greater than that due merely to the cooling of the gas according to the ordinary law. PERRY VAUGHAN BEVAN.

Melbourne University, April 18.

PROF. BEVAN ascribes to me work done conjointly with Prof. Ramsay. An addendum to our paper (see *Proc. Roy. Soc.*) contains our account of experiments by Prof. Ramsay, especially directed to examine the question raised.

It has turned out that the gas possesses the same value of $\frac{pv}{T}$ as hydrogen, and that the value of this expression is not altered between − 90° and + 250°. The most trustworthy determination of the ratio of specific heats gives the number 1·65; but much dependence is not to be placed on the accurate value