one open to the air, and one with air sealed in—were heated together and successively to 100° C., 120°, 150°, 200°, 250°, 270°, and 300°, and the zeros observed. Even then, there still would remain to be explained the strange depression which I noticed in several sealed thermometers of lead-glass in the neighbourhood of 270°. At present, I regard the suggestion as neither proved nor disproved.

We are, in fact, only beginning to learn what silica and silicates are. I have quite lately, for example, found a critical point in the action of heat upon fire-clays, similar to the 270° point in the zeros (before referred to) of my lead-glass thermometers; and a similar point is known to exist in the relation of the refractive index of quartz to temperature. Results of this kind show clearly that thermometry is by no means an easy subject. Indeed, I might define it as a mixture of very complicated chemistry with very complicated physics.

Glasgow, March 28. EDMUND J. MILLS.

The Shuckburgh Scale and Kater Pendulum.

BY permission of Prof. T. C. Mendenhall, Superintendent of the United States Coast and Geodetic Survey, and of Weights and Measures, I enclose to you for publication, if deemed suitable, a note relating to an abstract of a paper by General J. T. Walker, R.E., F.R.S., published in NATURE of February 20 (p. 381).

As the subject-matter refers to U.S.C. and G.S. Bulletin No. 9, I take the liberty of enclosing it also.

O. H. TITTMANN.

United States Coast and Geodetic Survey, Office of Weights and Measures, Washington, D.C., March 13.

Last summer the United States Coast and Geodetic Survey published an investigation, Bulletin No. 9, on the relation of the yard to the metre.

As the result of this investigation, values were deduced for the length of certain historic standards in England which differed very materially from the values previously assigned to them in metric measures.

Thus the length of the Royal Society's platinum metre, certified by Arago to be 17.59μ too short, was found to be only 7μ too short.

This metre was compared by Captain Kater with a certain space (0–39°4 inches) on the Shuckburgh scale, and this space was in turn compared with his pendulum. It is therefore of interest to know whether the value deduced in the investigation referred to is accurate. It is the object of this note to call attention to a surprising verification of the deductions contained in Bulletin No. 9. Using the equation for the platinum metre found in that paper, namely—

Platinum Metre $= 1$ m. $- 7 \mu + 9.126 \mu$, t C°,

we find

at 15°·98 C., P.M. $= 1 + 138.8 \mu$;

but at this temperature Captain Kater found the space on the Shuckburgh scale

(0–39°4 inches) $=$ P.M. $+ 0.02400$ inch, or 0.6096 mm., whence the space in question of the Shuckburgh scale $= 1.007484$ m., and using for the coefficient expansion 18.85×10^{-6} for 1° C., we have at 16°·67

the space $= 1.0007614$ m.

NATURE of February 20 (p. 381) publishes an abstract of a paper by General J. T. Walker, R.E., F.R.S., "On the Unit of Length of a Standard Scale by Sir George Shuckburgh," appertaining to the Royal Society," in which he states that the Shuckburgh scale was taken to Paris and compared with one of the standard bars of the International Bureau of Weights and Measures, by Commandant Defforges. The result of this comparison reduced to 16°·67 C., and as given by General Walker is

the space $= 1.0007619$ m.

This agreement is perfect, more so, in fact, than the circumstances allow one to expect.

The agreement implies the correctness of the new values deduced in Bulletin No. 9 for the Ordnance metre and the platinum metre of the Royal Society, and gives the value of the metre as equal to 39°3699 inches as therein computed from Baily's and Sheepshanks's comparisons, which established the relation between the Imperial yard and the space on the Shuckburgh scale.

It is to be noted that General Walker, ignoring Baily's and Sheepshank's comparisons, and adhering to the Clarke value 39°3704 + inches, deduces the (the writer of this thinks) erroneous conclusion, that the space on the Shuckburgh scale equals 39°400428 inches, the value according to their comparisons being 39°399896 inches. If to this value be added 0·04090 inch, the amount by which the distance between the knife-edges of the Kater pendulum exceeds the space 0–39°4 inches, the resulting length of the Kater pendulum at 16°·67 C. is 39°44080 inches, a value practically identical with that published by Kater, which is 39°44085 inches.

The Green Flash at Sunset.

THE explanation of the bluish (?) green flash of light sometimes seen at sunset given in your note last week (p. 495) does not seem to me to be a sufficient explanation of all the observations. If the phenomenon were due simply to refraction it would last for only a fraction of a second, and the colour would be much more blue than green. But, so far as my own observations go, the colour may last for several seconds, and is a bright pea-green, exactly similar to that shown by the sun many degrees above the horizon in South India in September 1883. To produce that green, as I have shown elsewhere, all that is required is the absorption due to a great thickness of vapour, combined with a certain amount of dust—water dust or other.

I saw a very pretty example of this last July when off the coast of Vancouver, B.C. The air was very moist and the rain-band correspondingly strong, while fine dust was supplied by the land breeze carrying with it particles from the burning forests inland. The sky was cloudless, but the haze was thick enough to allow one to look at the sun while it was still some degrees above the horizon, and the disk appeared of a brilliant golden-red, gradually changing to yellow, and, finally, while part was still above the horizon, it became a bright pea-green. The spectrum was similar to that figured in my paper on the green sun (R.S.E. Trans., xxxii. 389).

A few days later I had a view of the sunset from the Selkirks, where the air was very dry, the rain-band slight, but the haze considerable. The colours of the sun's disk were much less brilliant, and never passed beyond the stage of a reddish-copper tint. C. MICHIE SMITH.

73 George Street, Edinburgh, March 31.

Foreign Substances attached to Crabs.

I MUST of course accept Prof. McIntosh's interpretation of his own statement, and admit that he has found *Molgula arenosa* frequently in the stomachs of Cod and Haddock. This Ascidian differs from the majority of its class in having allocryptic habits, but I have not yet made a sufficient number of experiments to be satisfied as to its edibility. It has also been a considerable difficulty to me that the extensive investigations of Brook and Ramsay Smith lend no support at all to the opinion that this Ascidian forms an article of food for ground-feeding fish. In any case the matter, though of much interest, is not one for discussion here, since *Molgula arenosa* is never one of the "foreign substances attached to crabs."

The statement made by Mr. Holt that "*Actinia mesembryanthemum* is a favourite food of the Cod," was so inconsistent with our knowledge of the habits and distribution of the two species that, as I expected, the grounds for his assertion prove to be entirely fallacious. My statement with regard to the offensiveness of Actinians to fishes was made after prolonged observation of the habits of the living animals and after experiment, while Mr. Holt bases his objection on the ground that the St. Andrews fishermen find *A. mesembryanthemum* to be a successful bait for Cod. One might as well argue that because bits of red flannel or of tobacco-pipe are highly successful baits in whiffing for Mackerel, therefore these substances form a "favourite food" of this fish. A moment's reflection also would have shown Mr. Holt that an Anemone impaled upon a fish-hook is a much less dangerous creature than one under natural conditions and with tentacles expanded.

During the past week an interesting observation of Eisig's has come under my notice which corroborates the view that the association between Crabs and Anemones is of primary importance for the protection of the Crabs. Eisig observed (see Journ. R.M.S., iii., 1883, p. 493) that an *Octopus* in its attacks upon a Hermit Crab would instantly retreat upon being touched by the stinging organs of the Actinian associated with it.

Plymouth, April 5. WALTER GARSTANG.