In Holland the tests are made by experts. In England they are applied by persons who, however well they may be qualified to examine candidates in navigation and seamanship, have certainly no *locus standi* in the matter of reporting upon the perfectness, or otherwise, of a man's visual organs.

The tests themselves that these navigation examiners have to apply are far from being perfect. They are established upon a wrong principle. Candidates are made to name colours, and according to the Parliamentary Report of 1887 "the only reasons for which they are reported as having failed are inability to distinguish red from green, and either from black by daylight, and red from green and either from ground glass by artificial light."

Candidates are first required to give correct colour names to a series of eight cards coloured black, red, green, pink, drab, blue, white, and yellow, respectively. A candidate is passed, however, if he names correctly the first three.

The second test consists in naming the colours of glasses some eleven in number, viz. ground glass, standard red, pink, three shades of green, yellow, neutral tint, two shades of blue, and white. The candidate need, however, only name the ground glass, the standard red, and the standard green.

Clearly, with such tests as these, the colour-blind may easily escape detection.

The Board of Trade return relative to colour tests for the year ending May 31, 1891, shows that out of 4688 candidates who presented themselves for masters' and mates' certificates, 31 were rejected on account of deficient colour sense. That these should be rejected after serving an apprenticeship to the sea, is manifestly unfair. The test should be applied at the commencement of their nautical career, and not when the initial stage is passed. Four of the 31 were reported as passing on subsequently undergoing examination, although medical expert opinion is emphatic in stating that colour-blindness is absolutely *incurable*. Perhaps it may be that the examiners were disposed, by their leniency in passing young men whose previous "failure in colours" proved them colour-blind, to atone in some slight form for the bad system which allows lads to spend the best years of their life in mastering the irksome details of a profession, before it informs them that they are visually unfitted for it. It is to be hoped that the investigation into the whole system of colour-testing at present being conducted by a committee appointed by the Royal Society, may lead to thorough and effective reforms.

T. H. BICKERTON.

ON VAN DER WAALS'S TREATMENT OF LAPLACE'S PRESSURE IN THE VIRIAL EQUATION: A LETTER TO PROF. TAIT.

MY DEAR PROF. TAIT,—I gather from your letter of September 28 (NATURE, October 8, p. 546) that you admit the correctness of Van der Waals's deduction from the virial equation (1) when the particles are infinitely small, in which case

$$\left(p + \frac{a}{v^2}\right) v = \tfrac{1}{3}\Sigma m V^2 \quad . \quad . \quad . \quad . \quad . \quad (1)$$

a representing a cohesive force, whose range is great in comparison with molecular distances; and (2) when, in the absence of a cohesive force, the volume of the particles is small in comparison with the total volume v, in which case the virial of the repulsive forces at impact gives

$$p(v - b) = \tfrac{1}{3}\Sigma m V^2 \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

For hard spherical masses, the value of b is four times the total volume of the sphere. But you ask, "How can the factor $(v - b)/v$, which Van der Waals introduces on the left (in the first case) in consequence of the finite dia eters of the particles, be justifiably applied to the term in K (or a/v^2) as well as to that in p?"

In my first letter I desired to avoid the complication entailed by the consideration of the finite size of the particles; but it appears to me that the argument there given (after Van der Waals) suffices to answer your question. For, if the cohesive force be of the character supposed, it exercises no influence upon any particle in the interior, and is *completely* accounted for by the addition to p of a/v^2. In so far, therefore, as (2) is correct when there is no cohesive force, the effect of such is properly represented by

$$\left(p + \frac{a}{v^2}\right)(v - b) = \tfrac{1}{2}\Sigma m V^2 \quad . \quad . \quad . \quad . \quad (3)$$

in which b is to be multiplied by a/v^2, as well as by p.

Yours very truly,

October 13. RAYLEIGH.

NOTES.

AT the Royal College of Physicians, on Monday, when the Harveian Oration was delivered by Dr. W. H. Dickinson, the Baly Medal was given to Prof. Michael Foster for distinction in physiology; the Morgan Medal to Sir Alfred Garrod for distinction in clinical medicine.

DR. DICKINSON, in the Harveian Oration, presented an admirably clear and vigorous account of Harvey's great discovery, and of the scientific results to which it has led. The earliest and most important of these results was the completion of Harvey's work by the discovery of the capillary system by Malpighi, who was born in the year in which Harvey published his famous treatise. "Harvey," said Dr. Dickinson, "had never seen a capillary, nor did the state of the microscope in his time allow of it. He was fain to conclude that the blood passed from the arteries to the veins partly by anastomoses but mainly by percolation, as water, to quote his own illustration, percolates the earth and produces springs and rivulets. Had it been possible, we may imagine the delight with which he would have witnessed the completion by vessels of his circular route." Dr. Dickinson also referred, among other results of Harvey's discovery, to embolism, and to our knowledge of inflammation, or at least as much of it as concerns the capillaries. In conclusion, he said:—"Knowledge has been advancing since Harvey's time in many and independent lines; the achievements of Bell, Bright, and Addison had no direct connection with his, but it is not too much to assert that the medicine of to-day is scarcely less permeated with the results of Harvey's discovery than is the human body with the circulation he discovered. It does not make him small to say that what he found out must have come to light had he never lived. If Columbus had not discovered America some one else must have done so before now. The law of gravity might even have been revealed in the fulness of time to another if not to Newton. But the discoverer is before his time; in this lies one measure of his praise; another, and a more important one, is in the results of his discovery."

THE Electrical Exhibition, to be opened at the Crystal Palace on January 1 next, promises to be one of great interest and importance. The requests for space—which already exceed a total of 200—include electric lighting plants for country and town houses, for mines, for steamships, for railway trains, and even for private carriages. There are also included the newest forms of motors, generators, accumulators, and other machinery employed for producing and storing electricity. Several of the more important exhibits at the Frankfort Exhibition will be

© 1891 Nature Publishing Group