FORCE.

§ 11. Force. — Experiment 1. From a piece of cardboard suspend, by means of silk threads, six pith-balls, so that they may be





about 2^{cm1} apart. Procure a clean, dry glass tube, about 40^{cm} long and 3^{cm} in diameter. Rub a portion of this tube briskly with a silk handkerchief, and hold it about 2^{cm} below the balls. The balls seem to become suddenly possessed of life. They gather about the rod, and strive to reach it. If we cut one of the threads, the ball will fly

straight to the rod, and cling to it for a time. The means by which the rod pulls the balls is invisible. Yet evidence is positive that the rod has an influence on the balls, — that it *pulls* them. Slip a piece of glass between the rod and the balls; still the influence is felt by the balls. The glass does not sever the invisible bonds that connect the balls with the rod.

Now slowly bring the rod near the balls, till they tonch. They at first cling to the rod; but soon the rod, as if displeased with their company, begins to push them away. Withdraw the rod; the balls do not hang by parallel threads as before, but appear to be pushing one another apart. Gradnally bring the palm of the hand up beneath the balls, but without touching them. The balls gradnally yield to the pull of the hand, and come together. Remove the hand, and they again fly apart. Matter does not seem to be the dead, inert thing which it is often called; it can *push* and *pull*.

Experiment 2. Raise one of these balls with the fingers, and then withdraw the fingers. Something from below seems to reach up, and pull the ball down again. The same happens with each one of the balls; every ball is pulled by something below. What is it that pulls the balls? Carry the balls into another room, the same thing occurs. Carry them to any part of the earth, the same thing occurs. It must be that it is the earth itself that pulls the balls. The earth pulls the fruit and the leaf from the tree to itself; it pulls all objects to itself; and more, — it holds them there. Attempt to raise anything from the ground, and you feel the earth's pull resisting you.

Attempt to break a string, or crush a piece of chalk, and you find

¹ Tables of the Metric Measures may be found in the Appendix, Section A.

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