down to zero, and at the instant the train comes to rest the constant (negative) acceleration abruptly ceases.

How would this show itself in our feelings? If I were sitting with my back to the engine, leaning against the wall of the carriage, I should feel a slight mutual pressure between my back and the wall. This would remain constant to the end, and then abruptly cease. It would be but slight (for any possible brake acceleration must be but a small percentage of that of gravity) in comparison with that which we feel when we lie down. Would its abrupt termination—there being by supposition no sudden change of velocity—be really unpleasant?

To take a fanciful example. If, as I sit in my chair, gravity were suddenly annihilated (for me): I should note the cessation of pressure, and, in so far as my body is elastic, there would be some change of conformation. The pressure in the blood-vessels would also be changed, &c. But, dealing with even such a large acceleration as this, would the instantaneous change be at all comparable with that of a sudden trifling change of velocity?

Anyone who has been in a lift at the moment the cord broke might be able to tell us what all this feels like: but he must be careful to distinguish between the sensations due to the first moment of his passage from those due to the last.

Caius College, Cambridge.

J. VENN.

The Definition of Force and Newton's Third Law.

PERHAPS your correspondents now engaged in discussing the value of dynamic terms could extend the range of their controversy a little, and deal with a subject of great importance which no text-books touch.

It seems to me that the definition of force as that which causes or alters motion is not reconcilable with Newton's law which asserts that every force is always opposed by an equal and opposite force.

How can a force opposed by an equal and opposite force perform work, or affect the motion of anything? We have here either a fallacy or an indefiniteness, and the matter is worth clearing up because it incessantly worries students who think.

March 23.

NEMO.

Green Colouring-matter of Decaying Wood.

ANYONE who lives in a fairly wooded part of the country must be familiar with the fact that at certain stages of decay fallen branches of trees are often to be observed among the dry forest-litter coloured more or less through their tissue with various shades of green. After an examination of thin sections with the microscope, I am unable to trace this to any saprophytic organism. Chemical analysis, on the other hand, reveals the presence of iron as the base of the green colouring-matter (using fairly strong nitric acid as a solvent), which—so far as the evidence at present goes—seems to be some organic salt of iron, the organic acid being probably furnished by the slow decomposition of the woody tissue. In the hope that some further light may be thrown on the origin of the green-colouring matter of many Tertiary green earths, I would ask the favour of being allowed to solicit references to any foreign literature of the subject with which any of the numerous readers of NATURE may be acquainted.

A. IRVING.

Wellington College, Berks, March 17.

THE HITTITES, WITH SPECIAL REFERENCE TO VERY RECENT DISCOVERIES.¹

I.

OF late much has been said concerning the Hittites, and, as might be expected in relation to such a subject, there have been fanciful hypotheses and wild vagaries, repugnant alike to the scientific method and the scientific spirit. But most persons, one would suppose, who have given serious attention to the subject, must have become convinced that there is a great vacancy in that map of the past which ancient history presents. Mighty kings, dynasties enduring, it may be, through thousands

of years, great peoples who had made no slight advance in civilization, have passed away without leaving any chronicle equal even to those which were extant concerning Egypt and Assyria before the decipherment of the hieroglyphics and the cuneiform characters. The recent change in public opinion concerning the Hittites is not due merely to the discovery of monuments and inscriptions in various parts of Asia Minor: a large proportion of these had been known to exist for a considerable time, some for a very long time. It must be referred rather to the recognition of an identity or similarity of character in these monuments and inscriptions. And thus has arisen the idea of an empire stretching from the Euphrates to the Ægean Sea. It is, however, doubtful whether—if we use the word "empire" in such a sense as we employ it when we speak, for example, of the Empire of Russia or the Empire of China—there is any ground for believing that a Hittite Empire ever existed. Most likely there were in Asia Minor many States, or even single cities, which were usually to a great extent independent, and the peoples of which were not, perhaps, altogether homogeneous in race, but which, under pressure of the necessities of war, formed a federation. This view accords with the passages in the First and Second Books of Kings which speak of the "kings of the Hittites" (2 Kings, vii. 6) and of "all the kings of the Hittites" for whom Solomon's merchants brought up out of Egypt chariots and horses (1 Kings, x. 28, 29). The testimony of these passages in relation to the greatness of the Hittite peoples has been till recently but little regarded.

That the Hittites thus spoken of in the Old Testament are to be identified with the Khita of the Egyptian monuments, and with the peoples of the land of Khatti in the Assyrian records, is coming out more and more clearly; and as an especial link joining together the peoples thus designated by the Egyptians and Assyrians may be mentioned the city of Carchemish. Holding the Upper Euphrates, the Hittites stood between the Egyptians and the powerful and warlike peoples of Mesopotamia. On a superficial view this may seem not to be the direct route from Egypt to Mesopotamia; but to lead an army by the apparently more direct way across the Syrian desert would have been difficult or wholly impracticable. Moreover, it would not have been easy for an army to make the passage of the Euphrates towards the mouth of the river. But by the upper course of the Euphrates, at or near the site of Jerablûs, the river could be crossed with comparative ease. On the site of Jerablûs (from which the British Museum obtained a few years ago most of the Hittite monuments now in the collection) stood in all probability the renowned city of Carchemish. This identification, attributed to Mr. Skene, was accepted by the late Mr. George Smith, who visited the place shortly before his death. It was this city of Carchemish (not to go back further in Assyrian or Babylonian history) of which Tiglath-Pileser, about 1100 years before Christ, says, "The city of Kargamis, belonging to the country of the Khatti, I smote in one day. Their fighting-men I slew, their movables, their wealth, and their valuables I carried off." He records further that he pursued the portion of the Hittite army which fled; that he crossed the Euphrates in boats covered with bitumenized skins; and that he returned triumphantly to his city of Ashur. The conflict between the Hittites and Assyrians was, however, destined still to continue for 400 years, during which time, though repeatedly sustaining defeat, the Hittites made again and again a determined resistance. It was the fortune of Sargon to end the conflict by the capture, in 717 B.C., of Carchemish and its king, Pisiris.

Previous Egyptian monarchs had engaged in conflict with the Hittites with more or less conspicuous success; but it was the renowned son of Seti, the great Rameses II., about 1330 B.C., whose war with the Khita, and the great battle fought with them at Kadesh, appear to have

¹ Based on Lectures delivered by Mr. Thomas Tyler at the British Museum in January 1888.