lose time if taken towards the equator; and gain if carried further from it. A clock for instance, that keeps correct time at London would lose 12 seconds a day in Paris, and at the equator would lose nearly 2¼ minutes. From these considerations we see the force of the requirement that the pendulum shall be such as shall vibrate seconds in the *latitude of London.*

Thirdly, we know that the earth's attractive force is different for different distances above or below its surface, and that in consequence of this it would be necessary to restrict the pendulum to some particular altitude, and so the level of the sea is selected as the most appropriate. It is very clear then that to determine the unit of length by means of so delicate an instrument as the pendulum it is necessary that it should beat seconds of *mean time*—not sidereal or solar time—in a *vacuum*, in the *latitude* of London and at the *level* of the sea.

The next step in the development of the system brings us to the unit of weight:—this is now the pound Avoirdupois. In the Office of the Exchequer at Westminster there is deposited a cylinder of platinum (marked P. S. 1844, 1 lb.) and this weight is the Imperial standard pound Avoirdupois, and is the only standard measure of weight from which all other weights and measures having reference to weights are derived, and one equal seven-thousandth part of such pound Avoirdupois is a grain, and 5760 such grains is a pound Troy (18 and 19 V. c. 72, s. 3). This unit is connected with the unit of length by the same Statute that derived the unit of length from that of time, wherein it is declared that a cubic inch of distilled water, weighed in air, by brass weights, at 62° F. the barometer being at 30 inches, is equal to 252.458 grains, and that 7,000 such grains are a pound Avoirdupois, and 5,760 grains a pound Troy. It was supposed that by this means a new standard could be constructed should the old one be lost or destroyed, but when the old standards—there was a standard Troy pound as well, up to this time—were lost by the burning down of the Houses of Parliament, the Commissioners did not restore them by pursuing the above method, but as in the case of the standard yard, constructed the present standard by a comparison of copies that had been carefully made of the former one.

Let us now examine into the conditions under which this cubic inch of distilled water has to be weighed before it will furnish us with a sufficiently reliable standard.

Firstly, then, why limit it to being weighed in air? For the simple reason that every substance on being weighed in air weighs less than its true weight by the weight of the quantity of air displaced, which is considerable, enough to make a perceptible difference in weighing even so small a volume as a cubic inch. The weight of the air which would occupy one cubic inch of space is about one-third of a grain, not a very great weight absolutely, but a weight of great importance comparatively when we bear in mind that the chemical balance is so finely constructed as to detect a difference in weight so small as the one-thousandth part of a grain. As an illustration of the weight of the atmosphere I may say that the air in this room weighs 1,340 lbs.

Secondly, what has the height of the barometer to do with it? When the barometer stands high we know the air is heavier, meaning by this that a greater mass of air is crowded into the space of a cubic inch, and consequently one cubic inch of water displaces a greater weight of air when the barometer is high than when it is low, that is, the apparent weight of this cubic inch of water grows less the higher the barometer rises. Let us examine now whether a small change