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## SECTION IV.

## SOME ADDITIONAL EXPLANATIONS ON THE IMPORTANT FUNCTIONS OF THE TWILIGHT CIRCLE IN THE STUDY OF THE DYNAMICAL BRANCH OF PHYSICAL GEOGRAPHY.

It is well understood, twilight is due to that optical property of the atmosphere, whereby, when the sun is below the local horizon, its rays by reflection and refraction are enabled to illuminate a portion of the sky beyond the twilight circle or the real geometrical boundary of the globe's illumination. This partial illumination occurs as long as the sut. is less than 18° below the edge of the zone. As soon as it descends further then that distance twilight ceases, hence the globe viewed in the perspective from the outside, and from a point at right angles to the line joining the globe and sun, it will present the following appearances : It will have a brilliant, half illuminated hemisphere towards the sun, then a baund or zone of faint light, named twilight, 18° or about 1250 miles wide on the globe's surface, and lastly a large portion of a half hemisphere, in to al darkness. Now in the daily rotation of the earth every portion except the two Frigid zones passes through the twilight phase twice in every rotation of the globe. Hence very great differences occur in the duration of twilight according as the place passes below the solar horizon perpendicularly or obliquly. On looking at the apparatus it is obvious that when any place passes perpendicularly it will reach the distance of 18° much sooner than where it passes very obliquely. In the study of this branch of topography it will always be very profitable to the pupil to illustrate the different conditions in which the globe and the twilight is placed in, and especially at the beginning of the various seasons of the year. For example, examine the position of the twilight at the two solstices. At this period it will be manifest that the zone will be concentric over every meridian on the earth at the noon passage, at right angles to them, and every place, when it comes to the twilight circle passes from below at the same instant of time, an occurence which takes place at no other time in the year. Hence from pole to pole on the earth every place on June 21st and Dec. 21st have their shortest twilights, because every parallel of latitude moves through the zone at RIGHT ANGLES, which is the shortest path.