

The time required for the moon to move from a position relative to a star to the same position again is called the **sidereal month**. This is equal to 27.32 days. The time between new moon and new moon, or the time occupied by the moon in revolving from a position relative to the sun to the same position again, is a **synodic month**. This latter month varies in its length on account of the varying speed of the earth about the sun; the average length of the synodic month is 29.53 days. This average synodic month is called the **Lunar month**. The **Calendar month** is the one recognized in ordinary life, and varies in its number of days, some calendar months containing 30 days, others containing 31 days, and one 28.

Phases of the Moon.—In its revolution about the earth the moon assumes various appearances, as the crescent shape, the half



FIG. 37. Phases of the moon. The sun shines from the right.

moon and the full moon. These various appearances are called its **phases**. The moon is an opaque body reflecting the light of the sun. It is evident that one-half of its surface will be illuminated at all times, but not all of this illuminated half is turned towards the earth. At new moon but the smallest rim of the hemisphere reflecting the sun's light is visible to the earth, while at full moon there is visible the whole of its illuminated hemisphere. Fig. 37 will assist to an understanding of the various phases of the moon. The earth is represented in the centre of the circle with one-half of its surface lighted by the sun to the right. The line marked by arrows shows the orbit of the moon about the earth. On the orbit line at various points is shown the moon with that hemisphere which is turned towards the sun illuminated, while outside each of these is represented the moon with only that portion of the illuminated hemisphere marked light, which is towards the earth. At A the moon is nearly between the sun and the earth, its lighted hemisphere being turned wholly from the earth. This is **new moon**. At E about one-fourth of the illuminated surface is visible. At C one-half of its lighted surface is visible, and the moon here is in its **first quarter**. At B all of its illuminated surface is visible, and the moon is said to be at its full. At D it is in its **third quarter**.

Rotation of the Moon.—Like the earth the moon has two motions. Besides revolving about the earth it also rotates on

its axis. That the latter is the case is evidenced by the fact that throughout its varying phases, and throughout the years its visible surface markings are always the same. This fact can be accounted for only on the assumption that the moon rotates on its axis in the same time and in the same direction as the earth, thus keeping the same face of the moon towards the earth.

Eclipses.—The source of light for the members of the solar system is the sun, from which the light radiates in straight lines. An opaque body like the moon or the earth, intercepts some of these light rays, and casts into space a long conical shadow. When another body enters this shadow it is said to be eclipsed.

The eclipse of the moon is caused by the passage of the earth, in its orbit, between the sun and the moon. The eclipse of the sun is caused by the moon, in its orbit, coming between the sun and the earth. In the eclipse of the moon the shadow of the earth is thrown on the surface of the moon; in the eclipse of the sun the shadow of the moon is cast on the earth.

The only time an eclipse can occur is when the plane of the moon's orbit coincides with the plane of the earth's orbit. If these coincidences were continuous then there would be an eclipse at every new moon, and at every full moon. But this is not the case. The plane of the moon's orbit is inclined to that of the earth's orbit at an angle of five degrees, and therefore one-half of the moon's revolution is performed above the plane of the earth's orbit, and the other half below it. This being true there are but two points in the moon's revolution where these planes intersect. These points are called **nodes**. If new or full moon occurs at these nodes there will be in the first case an eclipse of the sun, and in the second an eclipse of the moon.

In Figure 38 S represents the sun; M and M₁ the moon; E the earth; and the dotted lines from the sun represent the rays of light. The dark cone-shaped shadow, U, which the moon or earth casts, and where no light falls, is called the **umbra**, while the fainter shadow, P, where some light is received, is called the **penumbra**.

Eclipse of the Moon.—The eclipse of the moon may be either total or partial. In the total eclipse the whole of the moon passes into the umbra; but its surface is never wholly obscured. It presents a dark reddish appearance, due to the sun's light reflected to it from the earth. The partial eclipse of the moon takes place when the moon is not quite at the node

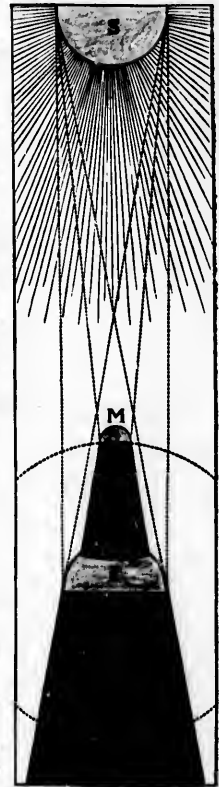


FIG. 38. Eclipse of the sun and moon.