

# AST 1106

## RETROGRADE MOTION

### Objective:

- To show that the apparent westward motion of a planet on the celestial sphere results from the relative motions of the Earth and the planet around the Sun.

### Apparatus:

Straight edge ruler and drawing pencil.

### Introduction:

The word planet means wanderer. Ancient astronomers called certain objects in the sky planets because their positions among the stars was observed to change from night to night. In general, these objects seemed to wander eastward among the fixed patterns of stars, but at times the planets appeared to stop and then, for a short time, seemed to move westward.

Our search for an explanation of this apparent motion was an important step toward changing our understanding the structure of the universe.

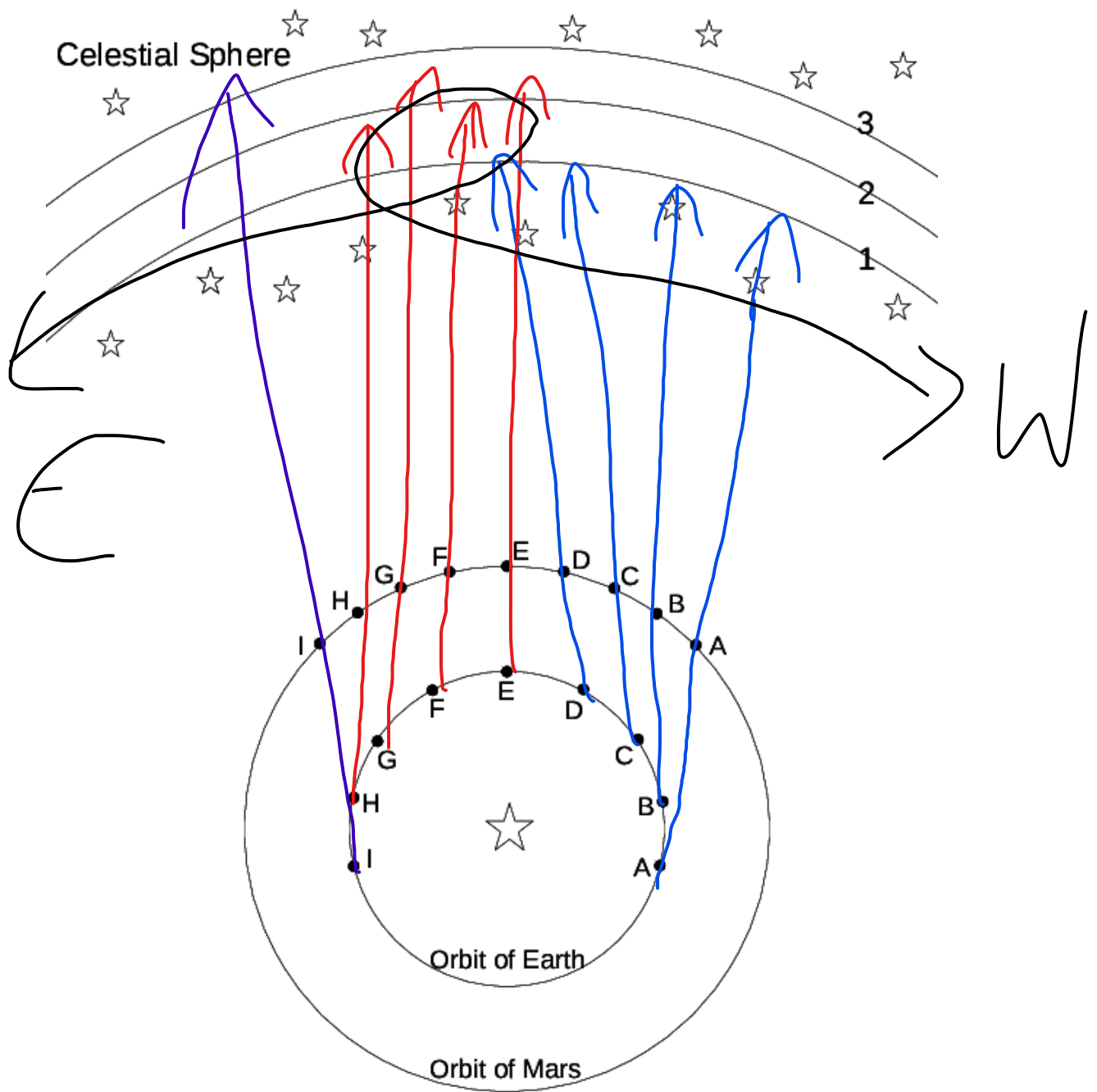
### Procedure:

In Figure *on your Data Page*, the inner circle around the Sun represents the orbit of the Earth and the outer circle the orbit of Mars. The spacing of successive letters represents the distance each planet moves during the period of one month measured on the Earth.

The two points marked **A** on the orbits represents the positions of Earth and Mars on the same date. An observer on Earth will see Mars in the direction of the line connecting those two points. Extending this line of sight gives the apparent position of Mars on the celestial sphere, also marked with an **A** and small circle to distinguish it from the stars.

1. To study the apparent motion of the planet during the next three-month period, connect the sets of points marked **A**, **B**, **C**, and **D**. Extend the lines to circular arc **1** on the celestial sphere. Mark each point of intersection with the appropriate letter.
2. When Mars is seen along line of sight **E**, the apparent motion with respect to the stars has become retrograde. When marking this apparent position on the celestial sphere, shift from circular arc **1** to arc **2**. (The orbits of Earth and Mars do not actually lie in the same plane as drawn on the Data sheet. The few degrees on inclination of the two orbits causes an apparent **North-South (N – S)** shift of the apparent position of Mars on the celestial sphere, approximated by the three circular axes.)
3. Continue plotting the apparent position of Mars on the celestial sphere for successive months. Shift to circular arc **3** when the apparent motion is no longer retrograde.
4. When all positions have been plotted, connect the points on the three circular arcs with a smooth curve and indicate the direction of the apparent motion of Mars among the fixed pattern of stars. Mark the **East (E)** and **West (W)** points on the celestial sphere, assuming that the North Pole of the Earth is out of the plane of the page in the diagram.

(Figure)



1.