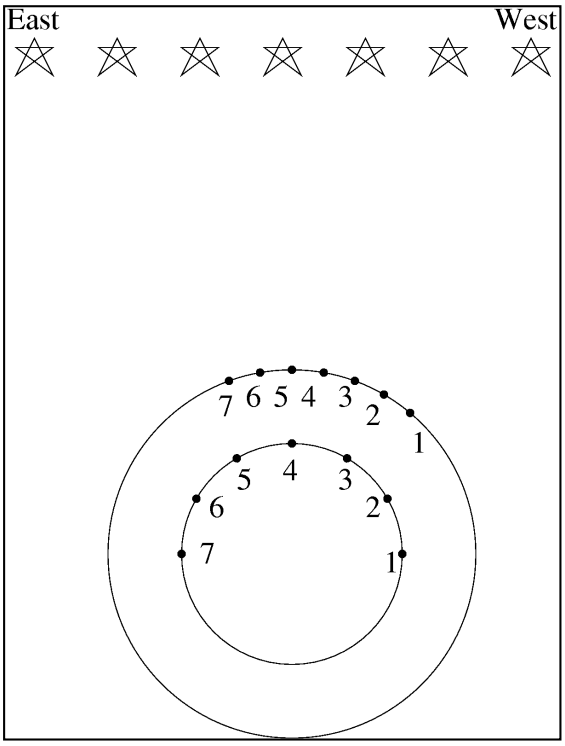
The Greek Geocentric (Earth-Centered) Theories for the motions of the planets were based on the following assumptions:

1. The Earth is the center of all motion.
2. The heavens are perfect, the Earth is not.
    a. Objects in the heavens do not change.
    b. Objects in the heavens are unblemished.
3. Objects in the heavens move in uniform circular motion.

Part I: Copernicus' Model and its differences from Earlier Geocentric Theories

Copernicus proposed a heliocentric hypothesis (or "model") of the universe in the mid-1500s. In the model, all the planets moved around the sun on circular orbits, and the Moon moved around the Earth on a circular orbit.

1. Which of the assumptions of the ancient Greeks, if any, does the Copernican model contradict? In other words, if you accepted the Copernican model, which assumption or assumptions must not be true? Why?



The diagram to the right shows the orbit of Earth (inner circle) and the orbit of Mars (outer circle) in Copernicus' Heliocentric model. Points 1 and 2 on the Earth's orbit are about one month apart, 2 and 3 are a month apart, and so on. The points on Mars' orbit have the same spacing—one month apart.

2. Which moves faster in its orbit, Mars or Earth? How do you know?

3. Work out how the position of Mars would appear to change when viewed from Earth. Do this by drawing a line from point 1 on Earth's orbit through point 1 on Mars' orbit to the stars. Repeat for points 2, 3, etc.

From	1→2	2→3	3→4	4→5	5→6	6→7
Mars appears to move (E→W or W→E)						

4. The "backwards" motion of Mars is called retrograde motion and is observed to occur! This motion is E→W. At which points is Mars moving in retrograde? Does Mars always move retrograde? Explain in words why (according to the heliocentric model) Mars appears to move backwards some times.

5. Explaining this observed retrograde motion of Mars was possible with Ptolemy's model (on the screen at the front) but required nesting epicycles on circles (sometimes several layers of circles). Do you think the motion of Mars in Copernicus' model is more simple or less simple than the motion in Ptolemy's model (on the screen at the front)? Do you think the simplicity of an explanation should matter in deciding whether Copernicus' model is better supported?

STOP HERE UNTIL TOLD TO MOVE AHEAD

6. The observations Galileo made are listed on the screen. For each of the assumptions the Greeks made in making their model of the solar system (top of the other side of this sheet), indicate which of Galileo's observations proved the assumption was incorrect. There might be more than one observation for each assumption.

Greek assumption	Galileo's observation	Explain why you think the observation(s) you chose contradicts the Greek assumption
1		
2a		
2b		
3		