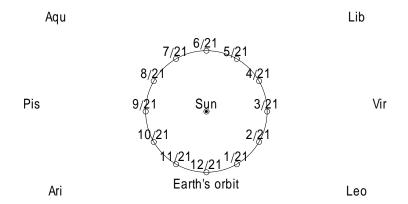You may use one sheet of notes. You may not use books or additional notes.

Do the easy questions first. Then go back to the harder ones.

Name	
PID	
1	/ 15
2	/ 7
3	/ 8
Total	/ 30

Planet	Period (yr)	Semi-major axis (AU)	Eccentricity
Mercury	0.241	0.387	0.206
Venus	0.615	0.723	0.007
Earth	1.000	1.000	0.017
Mars	1.881	1.523	0.093
Jupiter	11.86	5.202	0.049
Saturn	29.46	9.539	0.056

Sag

Cap   Sco

Aqu   Lib

7/21   6/21   5/21

8/21   4/21

Pis   9/21   Sun   3/21   Vir

10/21   2/21

11/21 12/21 1/21

Ari   Earth's orbit   Leo

Tau   Can

Gem

1. For these questions, you need to separate the key ideas from the details. Extraneous details will count against you. Write brief answers using a few complete sentences.

    a. (3 pts.) What quantities did Eratosthenes use to measure the size of the Earth?

    b. (3 pts.) What key piece of evidence did Mayor & Queloz use to argue that a planet, rather than a star, orbits the star 51 Pegasi?

    c. (3 pts.) On Venus, you are a year old before you are a day old. Explain how that is possible.

    d. (3 pts.) Planets usually move west to east with respect to the stars, but sometimes, they move east to west. This observation was a long-standing puzzle. What ultimately explained this observation? Explain how this observation caused a revolution in thought.

    e. Below are two paragraphs from Galileo's *Siderius Nuncius*. Pretend that Galileo saw three <u>stars</u> near Jupiter on 7 January, 1610 rather than three moons. Redraw what he saw on the 7th. (1 pt.) On the same picture, draw what he would have seen on the 8th. (2 pts.) In one or two sentences, point out and explain the differences and similarities between the real drawing and our hypothetical one.

    > On the seventh day of January in this present year 1610, at the first hour of night, when I was viewing the heavenly bodies with a telescope, Jupiter presented itself to me; and because I had prepared a very excellent instrument for myself, I perceived (as I had not before, on account of the weakness of my previous instrument) that beside the planet there were three starlets, small indeed, but very bright. Though I believed them to be among the host of fixed stars, they aroused my curiosity somewhat by appearing to lie in an exact straight line parallel to the ecliptic, and by their being more splendid than others of their size. Their arrangement with respect to Jupiter and each other was the following:
    >
    > East   *   *   O   *   West
    >
    > that is, there were two stars on the eastern side and one to the west. The most easterly star and the western one appeared larger than the other. I paid no attention to the distances between them and Jupiter, for at the outset I thought them to be fixed stars, as I have said.[18] But re-

    > turning to the same investigation on January eighth—led by what, I do not know—I found a very different arrangement. The three starlets were now all to the west of Jupiter, closer together, and at equal intervals from one another as shown in the following sketch:
    >
    > East   O   *   *   *   West
    >
    > At this time, though I did not yet turn my attention to the way the stars had come together,·I began to concern myself with the question how Jupiter could be east of all these stars when on the previous day it had been west of two of them. I commenced to wonder whether Jupiter was not moving eastward at that time, contrary to the computations of the astronomers, and had got in front of them by that motion.[19] Hence it was with great interest that I awaited the next night. But I was disappointed in my hopes, for the sky was then covered with clouds everywhere.

2. Comet X returns every 11.86 years, and its eccentricity is 0.99.

    a. (3 pts.) Find the length of its semi-major axis.

    b. (2 pts.) On a single diagram, draw the comet's orbit and Jupiter's orbit.

    c. (2 pts.) Does this comet get closer to the sun than Mercury? Explain your reasoning.

3. The drawing on the front page shows the constellations of the Zodiac.

    a. (1 pt.) At 9pm tonight, which constellations are completely or partially visible? (3 pts.) Explain. (1 pt.) Which constellation is setting?

    b. (1 pt.) The right ascension of the Crab Nebula is 6hr. Is it visible at any time tonight? (2 pts.) Explain.