

Name: _____

Quiz #1

1. One afternoon you are talking to your friend Pat about the motions of the Earth around the Sun. Pat is astounded by how fast the Earth moves around the Sun and asks if the other planets speeds are as large. In particular, Pat wonders about Mars thinking of all the probes we send to that planet. You aren't certain about the speed of Mars, but you know how to figure it out. To help out Pat, figure out the orbital speed of Mars in km/h. Mars orbits the Sun at a distance of 1.5 AU (you can assume a perfectly circular orbit) and takes 1.9 years to complete an orbit. (Remember that 1 AU=1.5*10⁸ km.) You don't have to keep more than 2 significant figures. You must show your work for full credit.

To find this we simply take the circumference of the orbit (2πr) and divide it by how long it takes to go around. The only trick is that we need the right units so we throw in the proper conversion factors to go from AU to km and from years to hours.

$$\frac{2 * 1.5 * \pi \text{ AU}}{1.9 \text{ years}} * \frac{1.5 * 10^8 \text{ km}}{1 \text{ AU}} * \frac{1 \text{ year}}{365 \text{ days}} * \frac{1 \text{ day}}{24 \text{ hours}} = \frac{1.41 * 10^9 \text{ km}}{1.66 * 10^4 \text{ hours}} = 8.5 * 10^4 \text{ km/h}$$

2. After falling asleep in class one day, you wake to find yourself lying on a cot on a deserted beach at sunset. Apparently the professor took significant exception to your snoring. As night falls you look to the sky hoping to get some idea of where you are. Immediately you notice the Big Dipper and Polaris. You do some simple measurements and figure Polaris is about 23 degrees above the horizon. Given this information, what can you say about your location?

Since you can see Polaris, you know that you are in the Northern hemisphere. That fact that Polaris is 23 degrees above the horizon means that you are very close to 23 degrees north latitude. Basically, you are very close to the Tropic of Cancer. You can tell nothing about longitude from this information.

Extra Credit: In the scenario of problem 2, the next day you notice that the Sun gets directly overhead and you cast no shadow. What time of year is it?

The fact that you aren't casting a shadow tells you that the Sun is at zenith. This is something that never happen in San Antonio, it only happens in the Tropics. Since you are located so close to the Tropic of Cancer, you know that the Sun only reaches zenith there on the summer solstice. From this you know that it is very close to the first day of summer.