

## Dark Matter and Dark Energy Problems

1. If you read about dark matter or dark energy you will see many different units of distance used. Below you will find a table that includes meters, astronomical units (AU), light-years (cy), and parsecs (ps). Use the data in the table to fill in the missing numbers.

distance	1 m is equal to	1 AU is equal to	1 cy is equal to	1 ps is equal to
m	1			
AU		1	$6.32 \times 10^4$	$2.06 \times 10^5$
cy			1	
ps	$3.24 \times 10^{-17}$			1

2. Some theories suggest that neutron stars harbor large quantities of dark matter. A typical neutron star has the same mass as our sun, but only has a radius of 12km. Find the acceleration due to gravity (a) at the surface of the sun and (b) at the surface of a neutron star.

3. Find the velocity for the lowest possible orbit around (a) the sun and around (b) a neutron star.

4. Find the radius of an object with the mass of the sun that would have a speed for the lowest orbit equal to the speed of light. See if you can find out the name of this radius and the name of such an object.