

ASTRONOMY 143
The History of the Universe
Professor Barbara Ryden

Problem Set # 2
Due Wednesday, Oct 14
at class time

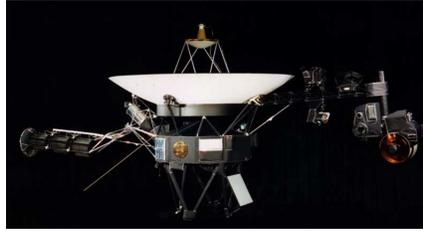
NAME (print clearly): _____

SCORE (instructor use): _____

1) [20 points] A glob of hot hydrogen gas, when it's not moving, produces an emission line with a wavelength $\lambda_0 = 656.3$ nanometers. Using a telescope, an astronomer sees a distant interstellar gas cloud with the same hydrogen emission line at a wavelength $\lambda = 656.5$ nanometers. Is the interstellar gas cloud moving toward us or away from us? What is the radial velocity of the interstellar gas cloud?

2) [20 points] At its closest approach, the planet Saturn is 8 astronomical units (AU) from the Earth. When Saturn is this close, how long does it take light to travel from Saturn to the Earth?

The Sun's nearest neighbor among the stars, a dim little star called Proxima Centauri, is 1.295 parsecs (pc) from the Earth. How long does it take light to travel from Proxima Centauri to the Earth?



3) [20 points] The Voyager 1 spacecraft, pictured above, was launched in September 1977, and is now the most distant human-made object. Voyager 1 is presently 111.3 astronomical units from the Sun, and is moving away from the Sun at a speed of 17,080 meters per second. If it were traveling directly toward Proxima Centauri, and maintained its present speed for the entire journey, how long would it take to reach Proxima Centauri?

4) [40 points] Given the answer to the previous problem, is it your opinion that manned interstellar travel is possible with present technology? (That's *interstellar* travel, not travel within our own Solar System.) Mention at least two of the problems that interstellar travelers would face, and briefly discuss how they could be resolved.