CENTRIPETAL FORCE & GRAVITY

Units 14 & 8 Dr. John P. Cise, professor of Physics, Austin Com. College, 1212 Rio Grande St., Austin Tx. 78701 jpcise@austincc.edu & NYTimes , August 24, 2016 by Kenneth Chang

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One Star Over, a Planet That Might Be Another Earth

An artist's impression of the planet Proxima b orbiting Proxima Centauri, the closest star to Earth's sun.

INTRODUCTION: Gravity supplies the required centripetal force to keep the planet in orbit: $G\,m\,M/R^2 = m\,v^2/R$, where $v = R\,\omega = R(2\,\pi/T)$, thus

$$G\,\cancel{m}\,M/R^2 = \cancel{m}\,[R^2 4\pi^2/T^2]/R$$

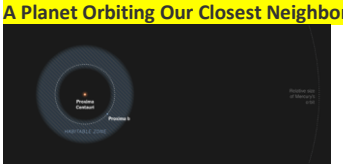
Thus, $$M = [4\pi^2/G](R^3/T^2)$$

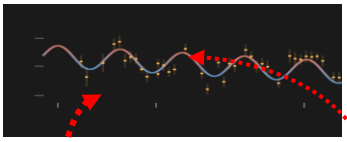
Where G = gravitational constant = 6.67×10^{-11} N $m^2/kg.^2$

QUESTIONS: (a) Convert 11.2 days to seconds?, (b) Convert 5 million miles to meters?, (c) Find mass of star proxima M?,(d) What % of sun mass is mass of Proxima star?, (e) Comments on your results?

Another Earth could be circling the star right next door to us. Astronomers announced on Wednesday that they had detected a planet orbiting Proxima Centauri, the closest neighbor to our solar system. Intriguingly, the planet is in the star's "Goldilocks zone," where it may be neither too hot nor too cold. That means liquid water could exist at the surface, raising the possibility for life. Although observations in recent years, particularly by NASA's Kepler planet-finding mission, have uncovered a bounty of Earth-size worlds throughout the galaxy, this one holds particular promise because it might someday, decades from now, be possible to reach. It's 4.2 light-years, or 25 trillion miles, away from Earth, which is extremely close in cosmic terms.

A Planet Orbiting Our Closest Neighbor, Proxima Centauri





HINTS: 24 hrs./day, 3600 s./hr., 1609.344 m. = mile , $M_{OUR\ SUN} = 1.989 \times 10^{30}$ kg.

ANSWERS: (a) 1.008×10^6 seconds, (b) 8.046627×10^9 meters, (c) 0.30346×10^{30} kg. (d) $[0.30346 \times 10^{30}/1.989 \times 10^{30}] = \sim 0.1535\ M_{OUR\ SUN}$
(e) Article at end said the planet proxima b had a approximate mass of 0.12 M_{SUN} So, your result of 0.15 M_{SUN} IS VERY CLOSE. Consider that the period T and distance Proxima b is from proxima star are close approximations. Thus, obtaining 0.15 M_{sun} vs. 0.12 M_{SUN} is very good. (-: Dr. Cise, Note: Dedicated to Drs. Mike & Barbara Endl

There is no picture of the planet, which has been designated Proxima b. Instead, Dr. Anglada-Escudé and his colleagues detected it indirectly, studying via telescope the light of the parent star. **They zeroed in on clocklike wobbles in the starlight, as the colors shifted slightly to the reddish end of the spectrum, then slightly bluish.** The oscillations, caused by the bobbing back-and-forth motion of the star as it is pulled around by the gravity of the planet, are similar to how the pitch of a police siren rises or falls depending on whether the patrol car is traveling toward or away from the listener. From the size of the wobbles, the astronomers determined that Proxima b is at least 1.3 times the mass of Earth, although it could be several times larger. A year on Proxima b — **(((the time to complete one orbit around the star — lasts just 11.2 days.))) (T = period)** Although the planet, lost in the glare of the star, cannot be viewed by current telescopes, astronomers hope to see it when the next generation is built a decade from now **(((This newly discovered planet is much closer to its parent star, about five million miles apart,))) (R = distance star to planet)** than Earth is to the sun, 93 million miles. The discovery was more than a decade and a half in the making. **Michael Endl, an astronomer at the University of Texas** and one of the authors of the Nature paper, peered at Proxima Centauri for eight years beginning in 2000, looking for hints of a planet. "At that time, I didn't see anything highly, highly significant," Dr. Endl said in an interview. "Then we published our data and moved on." Later, Dr. Anglada-Escudé, analyzing data from a different instrument on a different telescope, found inconclusive hints of a planet. He reached out to Dr. Endl to reanalyze the earlier data, and he also spearheaded the Pale Red Dot project, which tried to observe Proxima Centauri daily for two months earlier this year. The **new observations clearly revealed the 11.2-day period of the planet**, and the signal matched what Dr. Anglada-Escudé had suspected earlier. It also matched a signal that was hidden in the noise of Dr. Endl's data, which was lower in precision and observed Proxima Centauri once a week or so, not every day. While Proxima b might be similar to Earth, its parent star, Proxima Centauri, is very different from the sun. It is tiny, belonging to a class of stars known as red dwarfs, with **(((only about 12 percent of the mass of the sun)))** and about 1/600th the luminosity — so dim that it cannot be seen from Earth with the naked eye.