

Physics 108

Homework 5

1. Sunlight melts the comet and releases gas and dust. Light pressure from the sunlight pushes the dust out behind the comet, weakly, causing a dust tail "behind" the comet in its orbital path. The solar wind pushes the gas out from the comet, away from the sun, and ionizes the gas (or at least some of it), causing the plasma tail.

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2. The Kuiper belt lies in the plane of the ecliptic, more or less, while the Oort cloud is out there in all directions, like a spherical cloud or shell. The Kuiper belt is "close", from 40 AU to 50 AU, while the Oort cloud extends further out, to 50,000 AU or maybe even 100,000 AU.

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+5 3. a) The period of the comet is the length of time between appearances, 75 or 76 yrs.

+5 b) $1986 + 75 = 2061$ (or maybe early 2062)

+5 4. a) $30 \text{ AU} \times \frac{26 \text{ yd}}{1 \text{ AU}} = 780 \text{ yd}$

+5 b) $50 \text{ AU} \times \frac{26 \text{ yd}}{1 \text{ AU}} \times \frac{1 \text{ field}}{100 \text{ yd}} = 13 \text{ football fields}$

+5 c) $50,000 \text{ AU} \times \frac{26 \text{ yd}}{1 \text{ AU}} \times \frac{3 \cancel{\text{ft}}}{1 \cancel{\text{yd}}} \times \frac{1 \text{ mile}}{5280 \cancel{\text{ft}}} = 738 \text{ miles}$

+5 5. a) $r_{\text{Roche}} = 2.44 R_{\odot} = 2.44 (6.960 \times 10^8 \text{ m})$
 $= 1.688 \times 10^9 \text{ m}$

$$r_{\text{Roche}} = 1.689 \times 10^9 \text{ m} \times \frac{1 \text{ AU}}{1.496 \times 10^{11} \text{ m}} = 0.0114 \text{ AU}$$

+5 b) Mercury orbits at $57.9 \times 10^9 \text{ m} \times \frac{1 \text{ AU}}{1.496 \times 10^{11} \text{ m}}$
 $= 0.39 \text{ AU}$, so
 $\frac{0.0114 \text{ AU}}{0.39 \text{ AU}} \times 100\% = 2.9\%$

+2 c) Mercury is safe. It is well outside the Roche limit of the Sun.