PHYS275 – F17
Homework Assignment # 1
Solutions

1) Angular size is $\theta = \frac{s}{r}$ where θ is in radians and *s* is length of object and *r* is the distance to the object. $\theta = \frac{1.8\times10^{-2} meters}{110\times10^{3}\ meters} = 1.64\times10^{-7} radians.$

Convert radians to arcseconds [degrees(9.4×10^{-6}) or arcmin(5.6×10^{-4})] OK too: :

$$1.64\times10^{-7}\times\frac{180}{\pi}\times60\times60 = 3.4\times10^{-2} arcsec$$

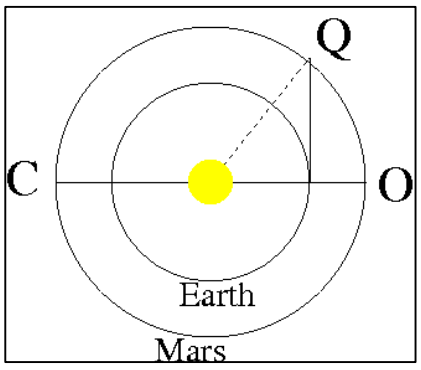
2) The object is in a "superior" orbit and has a synodic period S = 2.5 years. The relationship between synodic and sidereal period is then given by

$$S = 1 + (S/P)$$

and 2.5 = 1 + (2.5/P). Solving for P gives P=1.7 years. From $P^2=a^3$ and P=1.7 years we get a=1.4 A.U.

3) From sidereal period of 9.0 years we get a = 4.3 A.U. The perihelion distance is r_p=a(1-e) which is 2.0 = 4.3(1-e) and e=0.53

4) In picture Earth to Sun is 1.0 A.U., Mars to Sun is 1.52 A.U. The angular diameter of Mars will be $\frac{2\times radius}{distance}$ radians.



(a) At Opposition Mars is 0.52 A.U. from the Earth. Angular diameter is

$$\frac{2\times3.39\times10^{6}}{0.52\times1.50\times10^{11}} = 8.69\times10^{-5}\ radians = 18\ arcseconds$$

(b) At Conjunction Mars is 2.52 A.U. from the Earth. Angular diameter is $\frac{2\times3.39\times10^{6}}{2.52\times1.50\times10^{11}} = 1.79\times10^{-5}\ radians = 3.7\ arcseconds$

(c) At Quadrature Mars is $\sqrt{1.52^2 - 1.0}$ A.U. = 1.14 A.U. Angular diameter is

$$\frac{2\times3.39\times10^{6}}{1.14\times1.50\times10^{11}} = 3.95\times10^{-5}\ radians = 8.1\ arcseconds$$