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PHYS 215 **Selected Problems from Chapter One**

1. How long it takes a space craft moving at speed of 100,000 km/hr to reach Barnard's star system which is at a distance of about 5.5 ly from us?

distance = d = 5.5 ly × 9.46×10^{12} km/ly = 5.20×10^{13} km

time = t = d / v = 5.20×10^{13} / 100000 = 5.2×10^{8} hrs. = 2.2×10^{7} days
= 5.9×10^{4} yrs.

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2. How far away [in parsec (pc) and light years (ly)] is a star from us if a round trip journey takes about 200 years for a space craft that is moving at one tenth the speed of light?

time for round trip = 2 × t = 200 yrs. = 73050 days = 1753200 hrs. = 6.312×10^{9} s
time for one way = t = 6.312×10^{9} s / 2 = 3.156×10^{9}
speed = v = one tenth of the speed of light = 0.1 × 300000 = 30000 km/s

distance = d = (v × t) = 30000 × 3.156×10^{9} = 9.467×10^{13} km = 3.064 pc = 9.988 ly

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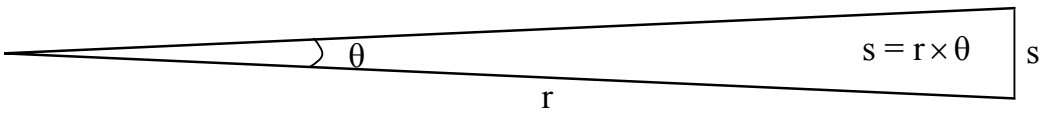
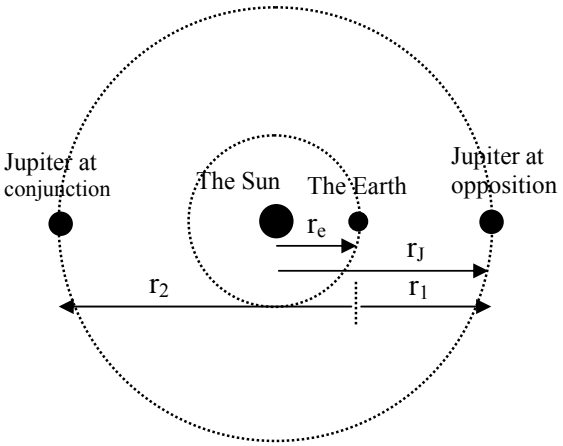
3. What is the angular size of Jupiter at the closest approach to the Earth (apposition) and the farthest distance from the Earth (conjunction)?



diameter of Jupiter = s = 142984 km
distance of Jupiter from the Sun = r_J = 5.20 au
Closest approach to the Earth
$r_1 = r_J - r_e = 5.20 - 1.00$
= 4.20 au = 6.3×10^{8} km
farthest distance from the Earth
$r_2 = r_J + r_e = 5.20 + 1.00$
= 6.20 au = 9.3×10^{8} km



$\theta_1 = s / r_1 = 142984 / 6.3\times10^{8} = 2.27\times10^{-4}$ rad
= 0.013 degrees = 0.78 arc minutes
= 46.8 arc seconds

$\theta_2 = s / r_2 = 142984 / 9.3\times10^{8} = 1.54\times10^{-4}$ rad
= 0.0088 degrees = 0.53 arc minutes
= 31.7 arc-seconds

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4. What should be the distance of a sphere (diameter = 30 cm) from us if its angular diameter is equal to 50 seconds of arc?

50 sec. of arc = 0.83333 min. of arc = 0.01389 degrees
= 0.0002424 rad.
r = s / θ = 30 / 0.00024 = 123759 cm = 1238 m = 1.24 km.

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