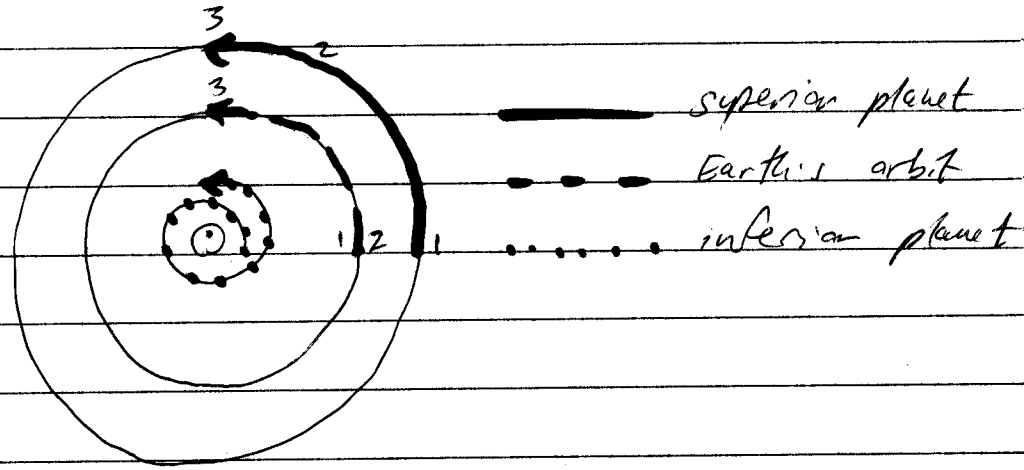
W1.a Intro to Modern Astrophysics Ch 1 # 1, 3, 4, 5, 6 . Zita
winter - week 1 due Mon. 12 Jan. 04

1.1/23 Derive the relationship between a planet's synodic period S and its sidereal period P : $\frac{1}{S} = \pm\left(\frac{1}{P_\oplus} - \frac{1}{P}\right)$
where $P_\oplus$ = Earth's period = 365d.

Fig 1.7



Earth makes $\frac{S}{P_\oplus}$ orbits around the Sun in time T.

In the same time, T, a superior planet makes _____ orbits.

Earth makes one extra lap to catch up at point 3

$$\#\ \text{Earth orbits} = \#\ \text{SP orbits} + 1$$

1.3 (a) The observed orbital synodic periods of Venus and Mars are 583.9 days and 779.9 days, respectively. Calculate their sidereal periods.

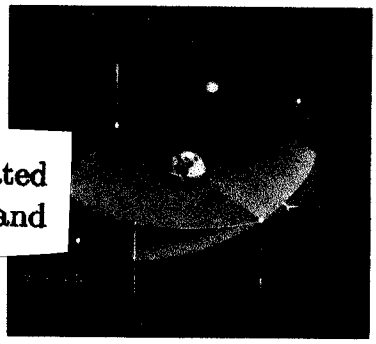
(b) Which planet in the solar system has the shortest synodic period? Why?

Venus is inferior: $\frac{S}{P} = \frac{S}{P_\oplus} + 1$ or $\frac{1}{S} = \frac{1}{P} - \frac{1}{P_\oplus}$

$\frac{1}{P_v} = \frac{1}{S} + \frac{1}{P_\oplus} = \frac{1}{583.9\,d} + \frac{1}{365.26\,d} =$ _____

$P_v =$ _____ d

1.4

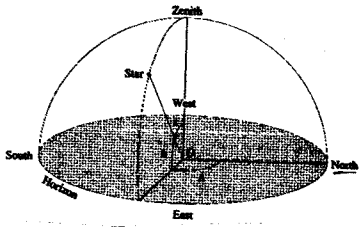


List the right ascension and declination of the Sun when it is located at the vernal equinox, the summer solstice, the autumnal equinox, and the winter solstice.

	α	δ
VERNAL EQUINOX		
SUMMER SOLSTICE		
AUTUMNAL EQ		
WINTER SOL		

1.5 (a) Calculate the altitude of the Sun along the meridian on the first day of summer for an observer at a latitude of 47° north.

(b) What is the maximum altitude of the Sun on the first day of winter at the same latitude?



W1.6 ASTRONOMY, PHYSICS, & MATH HW

due Mon 12 Jan 04

Candidate HW questions for week 1:

Astrophysics (Carroll and Ostlie)

Ch.1: Problems 1, 3, 4, 5, 6

Astronomy (Freedman & Kaufmann)

Ch.1: Review: 5, 11, 12, 15; Advanced: 18, 20, 22, 26, 27, 28, 30, 33

Observing: 42, 43 (Teams 1, 2)

Ch.2: Review: 6- 8, 10- 14, 16, 17, 20, 22;

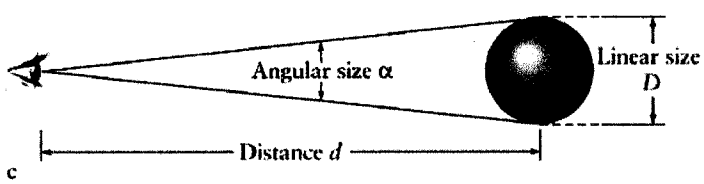
Advanced: 23, 29, 32, 34, 37, 38

Observing: 54, 56, 57 (Teams 3, 4, 5)

Mathematical Methods in the Physical Sciences (Boas)

Ch.5, Section 4, Problems 1 (a, d), 2(a), 4(a, b), 24, 25

Freedman and Kaufmann #1.30: The average distance (d) to the Moon is 384,000 km, and the Moon subtends an angle of 1/2°. Use this information to calculate the diameter of the Moon in km. (D)



arclength D = d α when α is in radians

2π rad = 360°

$\alpha = \frac{1}{2}° \left| \frac{2\pi \text{ rad}}{360°} \right| =$ _____ rad

$D = d\alpha = 3.84 \times 10^5$ km (rad)

D = _____ km

Universe - Ch 1 Advanced Q

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18. What is the meaning of the letters R I V U X G that appear under some of the figures in this chapter? Why in each case is one of the letters highlighted? (*Hint:* See the section "How to Use This Textbook" that precedes Chapter 1.)

R
I
V
U
X
G

$M_\odot$

20. The Sun's mass is 1.99×10^{30} kg, three-quarters of which is hydrogen. The mass of a hydrogen atom is 1.67×10^{-27} kg. How many hydrogen atoms does the Sun contain? Use powers-of-ten notation. N_H

M_H = mass of H in Sun = $\frac{3}{4} M_\odot$ = # H atoms in Sun × mass of each H

= $N_H \times m_H$

Solve for N_H =

$= N_\odot$

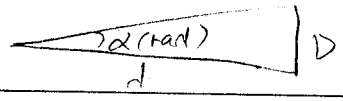
22. How many Suns would it take, laid side by side, to reach the nearest star? Use powers-of-ten notation. (*Hint.* See the preceding question.)

$= D_\odot$

21. The diameter of the Sun is 1.4×10^{11} cm, and the distance to the nearest star, Proxima Centauri, is 4.2 ly. = d

distance to star = number of Suns × diameter of Sun

*32. A person with good vision can see details that subtend an angle of as small as 1 arcminute. If two dark lines on an eye chart are 2 millimeters apart, how far can such a person be from the chart and still be able to tell that there are two distinct lines? Give your answer in meters.



$D = d\alpha$ (rad) : find α

*33. On December 11, 2000, the planet Venus was at a distance of 0.951 AU from Earth. The diameter of Venus is 12,104 km. What was the angular size of Venus as seen from Earth on December 11, 2000? Give your answer in arcminutes.

$D =$

Solve $D = d\alpha$ for α:

Extra: Could a person with good vision see the phases of Venus with naked eyes?