1. $\boxed{30^\circ N}$ (from his observation of motion of stars)

2. $\boxed{\text{Obliquity} = 0^\circ}$ (Equal days and nights)

3. Zun follows the $\boxed{\text{celestial equator.}}$

4. $\boxed{e = 0.}$ Constant solar day.

5. $P_{sid} = P_{sol}\left(1 + \frac{P_{sol}}{P_E}\right)^{-1}$

Plug in $P_{sol} = 10.101$ zour, $P_E = 1000$ zour

get $\boxed{P_{sid} = 10.000 \text{ zour}}$

6. Figure 2.1 in book.

$C = A/\cos(89.42704^\circ)$

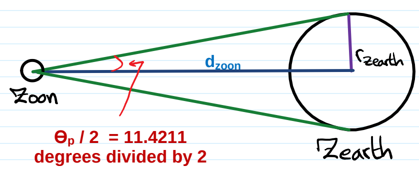
$C = 100.00\, d_{zoon}$ so $\boxed{100.00 \text{ times further.}}$

7. $$\frac{r_{zoon}}{r_{zun}} = \frac{\Theta_{zoon}}{\Theta_{zun}} \frac{d_{zoon}}{d_{zun}}$$

$$= \left(\frac{1}{10}\right)\left(\frac{1}{100}\right)$$

$r_{zun} = 1000.0\, r_{zoon} \Rightarrow \boxed{1000.0 \text{ times bigger}}$

8. $$\tan\left(\frac{\Theta_p}{2}\right) = \frac{r_{zearth}}{d_{zoon}}$$

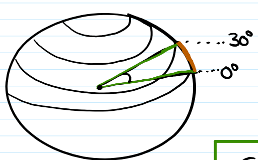


$\boxed{d_{zoon} = 10.000\, r_{zearth}}$

9. You walk from 30° N to Equator 0°.

arc = angle × radius

has to be in radians



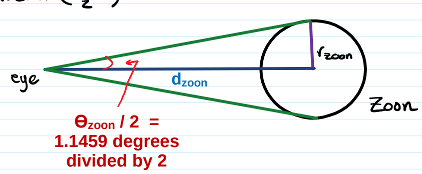
$523.599 = 30^\circ \frac{\pi}{180^\circ} \cdot r_{zearth}$

$\boxed{\text{Solve 8 } r_{zearth} = 1000.00 \text{ zilometers.}}$

10. $d_{zoon} = 10\, r_{zearth} = \boxed{10{,}000 \text{ zilometers}}$

$\tan\left(\frac{\Theta_{zoon}}{2}\right) = \frac{r_{zoon}}{d_{zoon}} \Rightarrow r_{zoon} = d_{zoon} \tan\left(\frac{\Theta_{zoon}}{2}\right)$

$r_{zoon} = \boxed{100.00 \text{ zilometers}}$



11. $r_{zun} = 1000\, r_{zoon}$ from (7)

$$\boxed{r_{zun} = 100{,}000 \text{ zilometers}}$$

12. 1 ZAu = distance between Zearth and Zun.

$d_{zun} = 100\, d_{zoon} = 1000{,}000$ zilometers

$$\boxed{\text{So } 1 \text{ ZAu} = 1000{,}000 \text{ zilometers}}$$

13. $$\boxed{\frac{r_{zearth}}{r_{zoon}} = 10 \qquad \frac{r_{zun}}{r_{zearth}} = 100}$$

14. $\tan\left(\frac{\Theta_d}{2}\right) = \frac{r_{zearth}}{d_{zun}} \Rightarrow \Theta_d = 2\tan^{-1}\left(\frac{r_{zearth}}{d_{zun}}\right)$

$$\boxed{1/500 \text{ radians or } 6.8755 \text{ arcminute}}$$

$$\boxed{\text{Yes eye can resolve this.}}$$

15. $P_E = 1000$ zours $\quad P_{V,syn} = 546.92$ zours

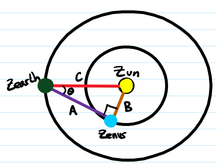
$$P_{zenus} = \left(\frac{1}{P_E} + \frac{1}{P_{V,syn}}\right)^{-1} = \left(\frac{1}{1000} + \frac{1}{546.92}\right)^{-1} = \boxed{353.55 \text{ zours}}$$

From (5) : 1 sidereal zay = 10 zours
Given : 1 zear = 1000 zours

$$\frac{353.55\ \cancel{\text{zours}}}{10\ \cancel{\text{zours}}/\text{sidereal zay}} = 35.355 \text{ sidereal zay}$$

So, $$\boxed{\begin{aligned} P_{zenus} = 353.55 \text{ zours} &= 35.355 \text{ sideral zay} \\ &= 0.35355 \text{ zear} \end{aligned}}$$

16. See figure 2.12 in book.



$C = 1$ ZAU

$B = C\sin\Theta$

$d_{zenus-zun} = (1 \text{ ZAU}) \sin 30°$

$= \boxed{0.50000 \text{ ZAU}}$

$= \boxed{500{,}000 \text{ zilometers}}$

Given: Zenus never gets further than 30° from the Zun, as seen by observer on Zearth

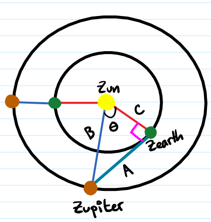
17. $P_E = 1000$ zours $\quad P_{J,syn} = 1032.655$ zours

$$P_{zupiter} = \left(\frac{1}{P_E} - \frac{1}{P_{J,syn}}\right)^{-1} = \left(\frac{1}{1000} - \frac{1}{1032.655}\right)^{-1} = \boxed{31623.2 \text{ zours}}$$

$= \boxed{3162.32 \text{ sidereal zays}}$

$= \boxed{31.6232 \text{ zears}}$

18. See Figure 2.13 in book.



In the time τ between opposition and eastern quadrature, Zupiter sweeps out angle $\omega_{Zup}\tau$ and Zearth sweeps out angle $\omega_{Z\acute{e}}\tau$

$$\omega_{Z\acute{e}}\tau - \omega_{Zup}\tau = \Theta$$

Look at ΔABC,

$\cos\Theta = C/B$

where $C = d_{zun} = 1$ ZAU.
$B = d_{zupiter-zun} = ?$

$\omega = 2\pi f$
$\omega = \frac{2\pi}{P}$
where P is period.

Now, given that $\tau = 24.17011$ zays $= 241.7011$ zours

So, $\omega_{ze}\tau - \omega_{zup}\tau = \tau(\omega_{ze} - \omega_{zup})$

$$= (241.7011 \text{ zours})(2\pi)\left(\frac{1}{P_E} - \frac{1}{P_{zup}}\right)$$

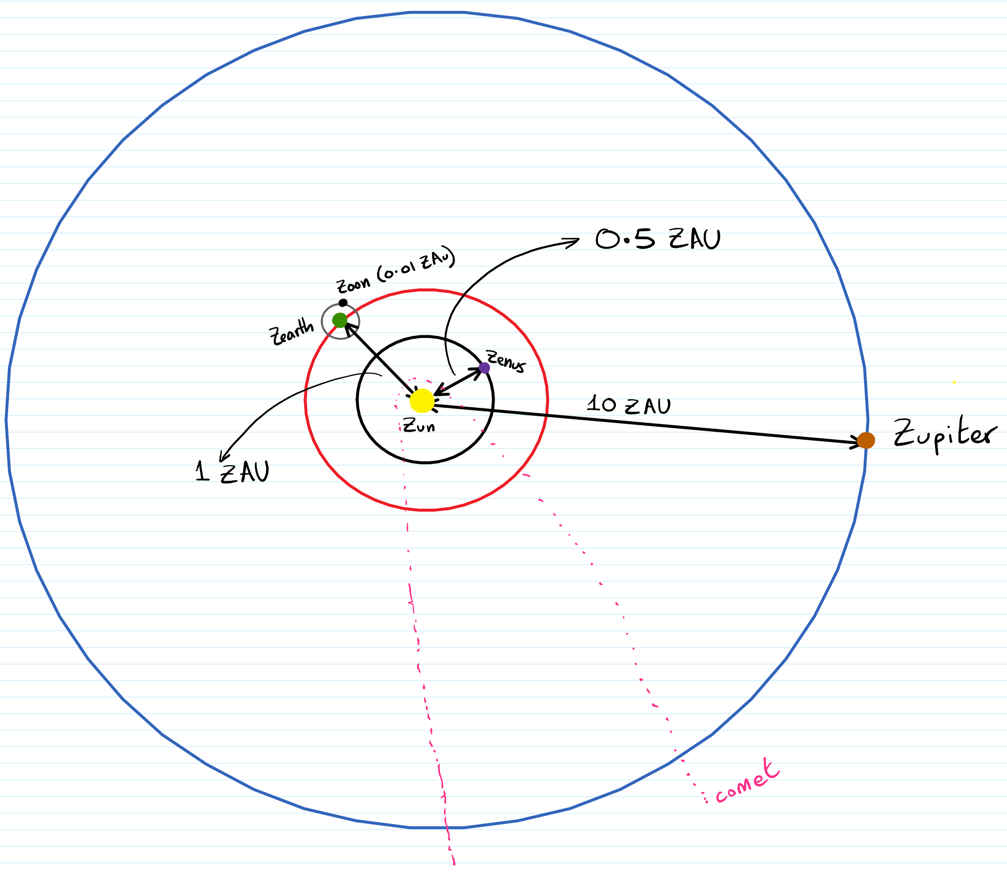
$$= (241.7011 \text{ zours})(2\pi)\left(\frac{1}{1000} - \frac{1}{31623.2}\right)(\text{zours})^{-1}$$

$$= 1.4706 \text{ rad or } 84.261^\circ$$

$$d_{zupiter-zun} = \frac{1 \text{ ZAU}}{\cos\theta} = \frac{1 \text{ ZAU}}{0.1} = \boxed{10.000 \text{ ZAU}}$$

$$= \boxed{1.00\times 10^7 \text{ zilometers}}$$

19.



20.

$\boxed{\text{Zearth}}$	$\boxed{\text{Zenus}}$	$\boxed{\text{Zupiter}}$
$P^2 = (1 \text{ zear})^2$	$P^2 = (0.35355 \text{ zear})^2 = 0.125 \text{ zear}^2$	$P^2 = (31.623 \text{ zear})^2 = 1000 \text{ zear}^2$
$a^3 = (1 \text{ ZAU})^3$	$a^3 = (0.5 \text{ ZAU})^3 = 0.125 \text{ ZAU}^3$	$a^3 = (10 \text{ ZAU})^3 = 1000 \text{ ZAU}^3$
$P^2 = Ka^3$	$P^2 = Ka^3$	$P^2 = Ka^3$
$\Rightarrow \boxed{K = 1 \text{ zear}^2 \text{ ZAU}^{-3}}$	$\Rightarrow \boxed{K = 1 \text{ zear}^2 \text{ ZAU}^{-3}}$	$\Rightarrow \boxed{K = 1 \text{ zear}^2 \text{ ZAU}^{-3}}$

Yes Kepler's Third Law holds.

21. $\boxed{K = 1 \text{ zear}^2 \text{ ZAU}^{-3}}$

1000 zour $= 1$ zear

10 zour = 1 sidereal zay

$\Rightarrow$ $\boxed{\text{100 sidereal zays in 1 zear.}}$

$$K = (100 \text{ sidereal zay})^2 \text{ ZAU}^{-3} = \boxed{1 \times 10^4 \text{ zay}^2 \text{ ZAU}^{-3}}$$

$$K = (1000 \text{ zour})^2 (10^6)^{-3} = (10^6)(10)^{-18} \text{ zour}^2 \text{ zilometer}^{-3}$$
$$= \boxed{10^{-12} \text{ zour}^2 \text{ zilometer}^{-3}}$$

22. $e = 0.999$ $\quad r_p = 0.1$ ZAU

See book pg 69.

$$r_p = a(1-e) \Rightarrow a = \frac{r_p}{1-e} = \frac{0.1 \text{ ZAU}}{1-0.999} = \frac{0.1}{0.001} = \boxed{100.0 \text{ ZAU}}$$

23. Kepler III

$$P^2 = Ka^3 = 1 \text{ Zear}^2 \cancel{\text{ZAU}^{-3}} (100)^3 \cancel{\text{ZAU}^3}$$

$$\Rightarrow P^2 = 10^6 \text{ Zear}^2$$

$$\boxed{P = 10^3 \text{ Zear}}$$