1, a)

Star A has twice the trigonometric parallax angle as B means that

$p_A = 2p_B$

Recall

$d[pc] = \frac{1}{p[arcsec]}$ } parallax formula

$$\frac{d_A}{d_B} = \frac{\frac{1}{p_A}}{\frac{1}{p_B}} = \frac{p_B}{p_A} = \frac{p_B}{2p_B} = \frac{1}{2}$$

$\Rightarrow$ **Star A is $\frac{1}{2}$ as far away as star B**

b) What are their relative brightnesses?

$f = \frac{L}{4\pi d^2}$ } formula for flux/apparent brightness

$$\frac{f_A}{f_B} = \frac{\frac{L_A}{4\pi d_A^2}}{\frac{L_B}{4\pi d_B^2}} = \frac{L_A}{\cancel{4\pi} d_A^2} \cdot \frac{\cancel{4\pi} d_B^2}{L_B}$$

$$= \frac{d_B^2}{d_A^2} \quad \text{since } L_A = L_B$$

Remember from part (a)

$$\frac{d_A}{d_B} = \frac{1}{2} \Rightarrow \frac{d_B}{d_A} = 2$$

$$\Rightarrow \frac{f_A}{f_B} = \left(\frac{d_B}{d_A}\right)^2 = (2)^2 = 4$$

Therefore star A is 4 times brighter than star B.

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2. In the H-R diagram stellar Luminosity is plotted against stellar surface temperature.

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3. $d[pc] = \frac{1}{p[arcsec]}$; $p = 2$ arcsec.

$$\boxed{d = \frac{1}{2} pc}$$

辉

4a $T_C = 2000\,K$

$T_D = 6000\,K$

You know Hotter objects emitt more energy so the star D must emitt more energy per unit surface area

Detailed Analysis

Stefon-Boltzmann Law

emitted power (~~per~~ m^2) $= \sigma T^4$

σ is a constant equal to $5.7 \times 10^{-8} \frac{\text{watt}}{m^2 \times K^4}$

(you don't need to know this #)

See page 169 in Bennett

Lets call j the symbol for emitted power per square meter

$j_C = \sigma T_C^4$

$j_D = \sigma T_D^4$

$$\frac{j_C}{j_D} = \frac{\sigma T_C^4}{\sigma T_D^4} = \left(\frac{T_C}{T_D}\right)^4$$

$$= \left(\frac{1}{3}\right)^4$$

$$= \frac{1}{81}$$

⇒ Star D emits 81 times more power per square meter than star C

4b) If star C and D have the same Luminosity and from 4a, we know star D is emitting more power per square meter, then we know star C must be bigger.

Analysis

$$L = (\text{surface Area}) \cdot (\text{power per square meter})$$

$$= (4\pi R^2) \cdot (\sigma T^4)$$

↑ surface area of a sphere

↑ stefan-Boltzmann

$L_C = L_D$

$T_C = 2000 K$

$T_D = 6000 K$

$$1 = \frac{L_C}{L_D} = \frac{\cancel{4\pi\sigma} R_C^2 \cdot T_C^4}{\cancel{4\pi\sigma} R_D^2 \cdot T_D^4} \Rightarrow 1 = \frac{R_C^2 T_C^4}{R_D^2 \cdot T_D^4}$$

~~Using~~

$$\Rightarrow \frac{R_D^2}{R_C^2} = \frac{T_C^4}{T_D^4}$$

4b continued

taking the square root of both sides

$$\frac{R_D}{R_C} = \frac{T_C^2}{T_D^2}$$

$$= \left(\frac{T_C}{T_D}\right)^2 \qquad T_C = 2000K \quad T_D = 6000K$$

$$= \left(\frac{2000}{6000}\right)^2$$

$$= \left(\frac{1}{3}\right)^2$$

$$\frac{R_D}{R_C} = \frac{1}{9} \Rightarrow R_C = 9R_D$$

So star C has a radius 9 times that of star D

5a) Compare luminosities of star E and star
star E has lower surface temperature
and twice the radius.

Lower temperature means that star E
is emitting less ~~the~~ power per square meter
but since the radius is larger it can't
be determined ~~[illegible]~~ ~~[illegible]~~ if the total
Luminosity is greater, smaller, or even
equal.

5b) Can't compare masses because there
isn't enough information

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6) Surface temperature is the most
important property that determines the
strength of the Hydrogen absorption
lines

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7) A star's parallax motion is due to
the Earth's motion around the sun

8] Star A and B have identical spectral type but A is much redder than B

So A must me the same temperature as B, but reddened by dust.

⇒ i. F star A has equal surface temp to B
ii. F Not necessarily
iii. F other way around – A is is reddened by d
iv. F. Not necessarily

---

9) Star A has twice the surface temperature as B. We know more massive stars on the main sequence are hotter, bluer and brighter

⇒ i. true
ii. true
iii. true
iv. true

---

10. Alpha Centauri
4.37 light years away

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11. i. False – A could just be closer
ii. True
iii. False
iv. False

$T = 2900K$

$$\lambda_{max} = \frac{.29 \text{ cm} \cdot K}{T}$$

$$= \frac{.29 \text{ cm } K}{2900 \text{ K}}$$

$$= \frac{2.9 \times 10^{-3} \text{ m}}{2.9 \times 10^{3}}$$

$$= \boxed{10^{-6} \text{ m}}$$

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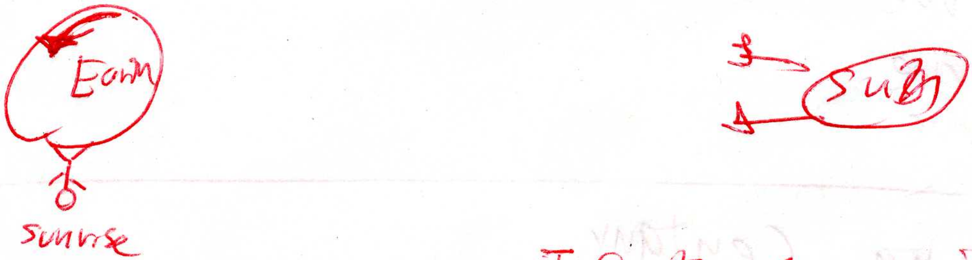
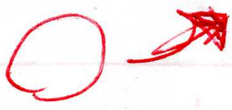
4)





3rdQ

If the moon is at your zenith at sunrise, the moon is in 3rdQ.

7 days later; New moon
14 days later; 1stQ
21 days later; Full

15) AM radio longest wavelength
FM radio
Infrared
Blue light
x-rays shortest wavelength

See page 155

or section 5.2
"properties of light"
Bennett

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16) $f = 10^5$ Hz

$c = 300{,}000 \frac{km}{s}$

$f \cdot \lambda = c$

$\lambda = \frac{c}{f}$

$= \frac{3 \times 10^5 \frac{km}{s}}{10^5 \cdot \frac{1}{s}} = \boxed{3 \text{ km}}$