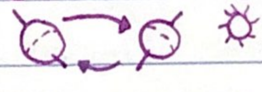
Julia Nelson HW 1 PEP151

Problem 1 (a):

→ if Earth's axis has no tilt + is perfectly ⊥ to the ecliptic plane...

There would be No more seasons. This is because, with a tilt, the Earth rotates + different hemispheres lean closer to the Sun at different times



Without the tilt, both the Northern + Southern hemispheres having equal length days and recieve the same amount of light from the Sun → making no more differing seasons on Earth, but the same temp/weather across the Earth.

Problem 1 (b):

→ if the Earth's axis is in the ecliptic plane...

One side of the Earth would have an extreme summer season facing the Sun for an extended time. While on the opposite side of the Earth, at the same time, is experiencing an extreme winter from no sunlight from facing away from the Sun.

Problem 2

Sun is 27,000 ly from center of our galaxy

(a):   light-year(ly): dist. light travels in a year
to Sun's dist from galactic center
from Ly to km

$1\ ly = 9.46 \times 10^{12}\ km$

$27{,}000 \times 1\ ly = 27{,}000 \times (9.46 \times 10^{12}\ km)$

$27{,}000\ ly = 255420 \times 10^{12}\ km$

The Sun's dist (km) from galactic center $= \boxed{2.5542 \times 10^{17}\ km}$

(b):

$1\ AU = 1.5 \times 10^{8}\ km$

Sun dist $= 2.5542 \times 10^{17}\ km$

Sun's distance (in AU) $= \dfrac{2.5542 \times 10^{17}\ km}{1.5 \times 10^{8}\ km} \times 1\ AU$

$= 1702800000\ AU$

$\boxed{= 1.7028 \times 10^{9}\ AU}$

Problem 3 Neutron star density 5×10^{17} kg/m³

(a):

Mass 1 teaspoon of material from Neutron Star?

1 teaspoon volume = 5×10^{-6} m³

$$\frac{5 \times 10^{17} \text{ kg}}{1 \text{ m}^3} = \frac{x \text{ kg}}{5 \times 10^{-6} \text{ m}^3}$$

$$\frac{(5 \cdot 10^{17} \text{ kg}) \times (5 \cdot 10^{-6} \cancel{\text{m}^3})}{(1 \cancel{\text{m}^3})} = x \text{ kg}$$

1 Teaspoon Mass = x kg = 2.5×10^{12} kg

(b):

Empire State Building = 3.3×10^{8} kg

$$\frac{\text{mass 1 Teaspoon}}{\text{mass Empire State Building}} \quad \frac{2.5 \times 10^{12} \text{ kg}}{3.3 \times 10^{8} \text{ kg}} = 7575.75757576$$

Mass of 1 Teaspoon of Neutron star material = The Mass of 7575.7576 Empire State Buildings

Problem 4

(a):

Tropical Year = 365.2422 Solar Days

= 366.2422 Sidereal Days

(366.2422) Sidereal Day $= (365.2422)$ Solar Days

$$1 \text{ Sidereal Day} = \frac{365.2422 \text{ Solar}}{366.2422 \text{ Sider}} = 0.997269566$$

$$\boxed{= 0.99727 \text{ Solar Days}}$$

(b):

1 Solar day = 24:00:00 hours

$$\frac{24:00:00 \text{ hrs}}{1 \text{ solar days}} = \frac{(:\ :\ ) \text{ hrs}}{0.99726956642 \text{ solar Days}}$$

$24 * (0.99726956642) = 23.9344695942$ hours

~~23~~$.9344695942 \times 60 \text{ min} = 56.0681756$ mins

$60 \text{ sec} \times 0.068176552 = 04.09053912$ sec

$\Rightarrow (23:56:04)$

1 sidereal ~~Sola~~r day = (23:56:04) (hh : mm : ss)

(c): if you took it at 9:00 pm on Earth...
to get the exact same distant stars
at the same positions the next night
you'd have to take it at 1 sidereal Day
later, not 1 solar Day.

So at (20:56:04) 8:56:04 PM
the next day

Problem 5

(a): Angle b/w zenith + north celestial pole?

Angle b/w zenith + NCP = Angle b/w celestial equator + horizon

$= 90° -$ latitude of observer

$= 90° - 41° = 49°$

(b): Angle b/w sun + zenith when highest in local sky + June solstice?

$\phi - 23.5°$

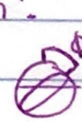
$= 41° - 23.5°$

$= 17.5°$

(c): on March equonx. + sun highest in local sky

Angle b/w sun + zenith?

$\cancel{90° - \phi \Rightarrow \phi}$



$\Rightarrow \phi = 41°$