Theoretical Test

Astronomy Model Answers

A1. Atmosphere of Planets

See table: **+ 0.5** points for each correct marking, **-0.2** for each wrong marking.

A2. For winter solstice, $a_w = 90 - \phi - \varepsilon$

For summer solstice (in northern tropical region), $a_s = 180 - (90 - \phi + \varepsilon)$

$= 90 + \phi - \varepsilon$

Using these, Inclination of the Earth's axis, $\varepsilon = 23^o\ 26'$

Latitude of Mysore, $\phi = 12^o\ 17'$

(1.5 points for each of the four steps)

A3. Pluto and charon:

(a) By Kepler's Third Law, $a_0^3 = \frac{G(M_{pl}+M_{ch})T^2}{4\pi^2} = \frac{9GM_{pl}T^2}{32\pi^2}$ **(1.5 points)**

Hence $a_0 = 1.96\times10^7\, m$ **(1.5 points)**

(b) The distance of barycentre from Pluto will be $a_0/9$. **(1 point)**

By comparing, a:b = $\frac{a}{b} = \frac{1.965\times10^7}{9\times1.195\times10^6} = 1.83$ **(1 points)**

(c) One should try to resolve the Pluto-charon system, when the Pluto is closest to the Earth as thats when the angular separation will be highest. **(0.5 point)**

Let us say we are using optical wavelengths around 550nm (a slightly better approximation will be to use blue end of visible light around 400 nm)

$D = \frac{1.22\lambda}{\theta} = \frac{1.22\lambda d_{pl}}{a_0} \approx 15\, cm$ **(1.5 points)**

A4. H-R diagram

(a) Star of Largest Diameter **B** Star of Smallest Diameter **C** **(2 points)**

(b) **D** and **F** **(1 point)**

(c) **A, E** and **F** **(1.5 points)**

(d) C **(1 point)**