1. M: 1st quarter configuration
   S E

   Noon overhead: 6 PM
   High tide: 6 PM & 6 AM

2. Universe expands: "radius" $\sim \text{alt}^3$
   light redshift: $\lambda (t) \sim \text{alt}^3$

   $\lambda (\text{obs}) = \lambda (\text{emission}) \frac{a(t)}{a(t_{\text{emission}})} = 100 \text{ nm}$

   $\frac{50 \text{ nm}}{2}$

3. Use Kepler's law $p^2 \sim a^3$ or $a \sim p^{2/3}$
   
   p: period
   a: semimajor axis

   2nd planet: $d = 10^{2/3} d_{\text{first}}$
   3rd planet: $d = 10^{4/3} d_{\text{first}}$

4. Queen surrounded by hot shell of H
   (not the only possible answer)
5. distance vs redshift (Hubble)

\[ d_{2nd} = 1.5 \times d_{1st} \]

6. Resolution: your trajectory and that of your friend are not equivalent; your friend feels he/she is accelerating when departing and decelerating when arriving. He/she knows that it is he/she who is moving.

7. Hydrostatic equilibrium

Outward pressure force equal in magnitude to inward gravitational force

\[ F_p \downarrow \quad \text{as} \quad h \uparrow \quad (h: \text{height}) \]
\[ F_G \uparrow \quad \text{as} \quad h \downarrow \quad (g: \text{density}) \]

\[ F_p \sim g \]

\[ \Rightarrow \quad \frac{L_1}{L_2} = \left[ \frac{100}{M_2 - M_1} \right] \]

8. \[ L: \text{luminosity} \]
\[ M: \text{magnitude} \]
\[ \Rightarrow \quad L_{\star} = 10^4 L_\odot \]
\[ L \propto d^{-2} \quad d: \text{distance} \]

absolute brightness = apparent brightness at a distance 10 pc

\[ d = 10^2 \times 10 \text{pc} = 10^3 \text{pc} \]

9/10. Classical Bohr model: electron orbiting the nucleus

- classical physics: orbiting (i.e., accelerating) charge emits radiation
- loses energy
- orbital radius should decay
- instability

Quantum mechanical resolution:

\[ \text{electron} \rightarrow \text{static wave function} \]

\[ \sqrt{\text{probability wave}} \]

\[ \Rightarrow \text{no radiation} \]

\[ \Rightarrow \text{no decay} \]