

Review for Unit #2

How many questions will be on the test?

How specific will the questions over the first part of the semester be?

What would you suggest to be the best way to study?

How to study?

- 1) Read the lecture notes. For each lecture, think about what are the most important two or three messages from the lecture. Try to imagine two or three questions that would test if one understood the main points of the lecture.
- 2) Go over the homework, particularly problems that you missed, until you understand each problem (not just know the right answer). Do this by talking with a friend.
- 3) Read the textbook if you need to find answers from steps 1 or 2.

Some useful numbers:

Radius	Distance
Moon = 1.7×10^6 m	Earth-Moon = 3.8×10^8 m
Earth = 6.4×10^6 m	Sun-Earth = 1.5×10^{11} m
Jupiter = 7.1×10^7 m	Sun-Jupiter = 7.8×10^{11} m
Sun = 7.0×10^8 m	Sun-Proxima Centauri = 4×10^{16} m

1 light-year = 9.5×10^{15} m

1 parsec = 3.26 light-years

$H_0 = 70$ km/s/Mpc

Equations:

$d = 1/p$ for d in pc, p in arcseconds

$$S = \frac{\alpha \cdot d}{206265} \quad \text{for } S, d \text{ in meters, } \alpha \text{ in arcseconds}$$

$$\frac{\text{Flux}_B}{\text{Flux}_A} = \frac{\text{Luminosity}_B}{\text{Luminosity}_A} \left(\frac{\text{Distance}_B}{\text{Distance}_A} \right)^{-2}$$

$$\frac{\text{Distance}_B}{\text{Distance}_A} = \sqrt{\frac{\text{Flux}_A}{\text{Flux}_B}} \quad \text{for standard candles}$$

$$\frac{\text{Luminosity}_B}{\text{Luminosity}_A} = \left(\frac{\text{Radius}_B}{\text{Radius}_A} \right)^2 \left(\frac{\text{Temperature}_B}{\text{Temperature}_A} \right)^4$$

$$\frac{\text{Lifetime}_B}{\text{Lifetime}_A} = \frac{\text{Mass}_B}{\text{Mass}_A} \left(\frac{\text{Luminosity}_B}{\text{Luminosity}_A} \right)^{-1}$$

Schwarzschild radius = 3 km (M/M_{Sun})

Eddington luminosity = 30,000 solar luminosities (M/M_{Sun})

Speed = $H_0 \times \text{distance}$

Questions are multiple choice

- If the exact numerical value you want is not there, then pick the closest number
 - By closest, I mean when dividing/multiplying
 - 300,000 is closer to 1,000,000 than to 1,000
- If a specific number has been on a homework problem, you should know it and closely related numbers

Suppose we were to discover that the distances to other galaxies had all been underestimated by a factor of two. How would our estimate of the age of the universe change? It would

- A) double
- B) remain the same
- C) quadruple
- D) halve

When was a galaxy now 7 Mpc away at the same position as the Milky Way?

Galaxy is 7 Mpc away

Recession speed = 500 km/s = 0.5 Mpc/Gyr

Time = distance / velocity

$$= 7 \text{ Mpc} / (0.5 \text{ Mpc/Gyr}) = 14 \text{ Gyr}$$

Galaxy is 14 Mpc away

Recession speed = 500 km/s = 0.5 Mpc/Gyr

Time = distance / velocity

$$= 14 \text{ Mpc} / (0.5 \text{ Mpc/Gyr}) = 28 \text{ Gyr}$$

The cosmic background radiation is almost the same in every direction. This implies that

- A) just after the Big Bang distant parts of the universe had to be close together
- B) the Big Bang had to be extremely hot
- C) the universe has to have a flat geometry
- D) the universe has to be at least 14 billion light years across

Horizon Problem

