

## 13.7: Mission Report 13 - How Well Do We Know the Expansion Rate and Age of the Universe?

. Please rate on a scale of 1 to 5 how effective you think the “Wrapping It Up” activity for this chapter was in helping you understand the material. (1: not effective at all → 5: very effective)

\*

1

2

3

4

5

B. What were the main ideas that you learned in conducting the “Wrapping It Up” activity for this chapter? Be specific and detailed in your response. Please address the following questions: What did you learn? How did you learn it? What is still unclear? (At least 150–200 words.)

\*

C. If the “Wrapping It Up” activity for this chapter included measurements or data, please describe what factors influenced the accuracy of your results. (Do *not* include mistakes, only unavoidable measurement imprecision.) If you obtained any numerical values for the accuracy of your measurements during the activity, note those here. If there were no measurements or data, say so explicitly.

\*

D. Questions to be graded for accuracy:

1. Would the Universe be older if the expansion rate was  $H_0 = 50$  km/s/Mpc or if  $H_0 = 75$  km/s/Mpc? Explain.

\*

2. What is the age of the Universe if the Hubble constant is measured to be 75 km/s/Mpc? Express your answer in billions of years. Would this value be consistent with the range for the Hubble time from the HST Key Project? Explain.

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3. On average, how do the velocities of far away galaxies compare to those of closer galaxies? Why?

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4. Based on the measurements you made in this chapter, how do you know that the Universe is expanding (stretching) but the individual galaxies are not?

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