

Part 1: Evolution of the Universe

Locate and open the interactive learning object, *Timeline of the Universe*, to answer the following questions.

1. How old is the Universe?

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2. What was created in the Big Bang?

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3. What came before the Big Bang?

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4. What was the early Universe like? How has it changed since the Big Bang?

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5. Why weren't atoms formed until 380 000 years after the Big Bang?

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6. Why is the Universe cooling as it expands?

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7. Why would hydrogen and helium be among the first atoms to form in the Universe?

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8. What is cosmic microwave background radiation?

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9. What does the WMAP image of cosmic microwave background radiation tell us about the early Universe?

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10. The WMAP image shows what the Universe was like 380 000 years after the Big Bang. How is it possible for scientists to 'look back in time'?

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11. How do gravity and gas pressure interact in the process of galaxy formation?

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12. If the Universe continues to expand at an accelerating rate, what do you think Earth's inhabitants will see when they look up into the sky billions of years from now?

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Part 2: Research questions

1. Why can't astronomers determine the size of the Universe?
2. What did Hubble discover about the Universe?
3. Hubble used redshift and blueshift measurements of light from distant galaxies to make his discovery. What do the terms redshift and blueshift mean and what do these measurements tell us about a galaxy?
4. Hubble first determined the age of the Universe to be 2 billion years. Why was this result rejected and what caused him to make such an error?
5. Penzias and Wilson pointed their antenna at the sky and discovered a 'noise' while they were researching reflected radio signals. How did they come to the conclusion that it was cosmic microwave background radiation?
6. How do cosmologists explain the increasing rate of expansion of the Universe?
7. Astronomers think that 25% of the Universe is made up of dark matter, although they don't know what dark matter is. What evidence is there that dark matter exists?
8. Astronomy, astrophysics and cosmology all contribute to our understanding of the Universe. What are these three areas of study and what do astronomers, cosmologists and astrophysicists do?