

1. In your own words, explain the following concepts:

A) Cosmic background radiation \_\_\_\_\_

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B) Redshift \_\_\_\_\_

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C) Hubble's law \_\_\_\_\_

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2. What was the explanation for the existence of cosmic background radiation?

- Since radio waves are no longer released by objects in the universe, they must have been released a long time ago by a very large explosion.
- This radiation is leftover energy from a giant supernova that collapsed into a massive black hole at the center of the galaxy.
- It is leftover light and heat from the early universe, spread out as the universe expanded, that has been traveling to us since the universe began.
- Cosmic Background Radiation is emitted by distant stars that are cooler than the stars which release heat and light energy.

3. How do we know that cosmic background radiation is ancient heat and light from the Big Bang? (Select 3)

- Its pattern is nearly uniform, unlike today's universe which is in clumps of matter with vast ranges of empty space. Cosmic background radiation is coming even from the empty spaces between the stars.
- The early universe was very hot and dense, and the heat is still hanging around as the universe cools. We can detect its presence with special technology that can measure temperatures in empty space.
- When we turn cosmic background radiation back into light, it looks round and blotchy. This is because the early universe was a sphere like the Earth.
- The light from the early universe is only just now reaching us, as it has been travelling for 13.7 billion years. This explains why it is red-shifted into radio and microwaves.
- If the Big Bang is how the universe began, there would have to be radiation in patterns that suggest the universe was once much denser with very little empty space between particles.

4. How can the pattern of red shift from distant galaxies give us evidence for what the universe was like in the past?

- Since closer galaxies are blue-shifted and more distant galaxies are red-shifted it shows that the universe began as a single point that exploded rapidly, expanding until it became stable in the present universe.
- Nearly all galaxies are red shifted, with the most distant galaxies being the most red shifted, showing that the universe is expanding. If it is expanding now, it must have been smaller and more dense in the past.
- Galaxies all appear red, showing us that they are farther away from us. This tells us that some galaxies are moving away from us and others are expanding, indicating that the universe was once very small.
- Red shift occurs when galaxies and stars expand, because the expansion causes cooling of matter and a change in color. This is evidence that galaxies were denser in the past.

5. In your own words, explain how cosmic background radiation and red shift give us evidence for the Big Bang.

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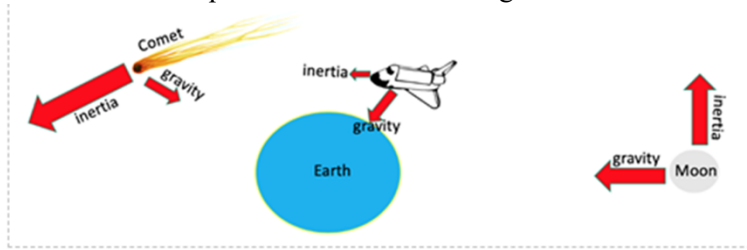
6. In your own words, create an explanation of how telescopes allow us to see far away items.

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For questions 4-6 use the image below



7. If a comet is flying on a path toward the Earth and its inertia is more than the amount of gravity pulling what would happen? \_\_\_\_\_  
\_\_\_\_\_
8. According to the model, what will happen to the motion of the space shuttle and why? \_\_\_\_\_  
\_\_\_\_\_
9. Why does the moon follow its path of orbit and not move any closer or farther from the Earth? \_\_\_\_\_  
\_\_\_\_\_
10. **Select all of the following** that explain the changes in the solar system during formation. **(Select 3)**
  - A. After the Big Bang, gravity pulled all the particles left over from this explosion into orbits around the sun.
  - B. As the mass at the center of the nebula became larger and denser, the gravity increased the heat and energy at its center until nuclear fusion reactions were created.
  - C. The solar system formed from a black hole that was spinning matter and energy out into space which were caught in the gravitational force of an orbit.
  - D. Gravity caused the material in a nebula to collapse in on itself and particles became larger and larger as they coalesced more and more mass.
  - E. The solar system began after an older star went supernova, leaving a spinning disk of debris that would give rise to orbital motions.
11. The sun and the moon appear to be the same size in our sky. Create an explanation for how scale and proportion allow the moon to have a much greater influence over Earth's tides. \_\_\_\_\_  
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12. Create an explanation for how gravity causes orbits. \_\_\_\_\_  
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13. Why does the sun have a stronger gravitational pull than the moon? \_\_\_\_\_  
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14. Explain the relationship between gravity and distance. \_\_\_\_\_  
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15. Why does distance from the sun affect the velocity of a planet? \_\_\_\_\_  
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Words to know: dense, uniform, eccentricity (eccentric), orbit, inertia, expansion, scale, proportion, emit (emitted), electromagnetic radiation, radio waves, microwaves, red shift, velocity,