

## Dark Matter Reading Comprehension

Name \_\_\_\_\_

Dark matter is a hypothetical form of matter that exists in our universe. There's a lot we still don't know about dark matter, but what we do know is that it makes up 27% of our universe, and that there's not enough visible matter in the universe to compose it. Dark matter doesn't appear in our sky in the form of the stars and planets we are used to. It also can't be dark clouds of normal matter, or antimatter; we don't detect any radiation absorption in dark matter like we would with matter, nor does dark matter produce gamma rays that are indicative of antimatter. In addition, dark matter can't be multiple galaxy-sized black holes, because dark matter doesn't bend light that approaches it. In fact, dark matter doesn't interact with electromagnetic forces at all. It doesn't absorb, emit, or reflect light. The only way for scientists to study its existence is to make inferences about it due to the gravitational effect it has on visible matter. Yet, despite the mystery surrounding it, dark matter outweighs visible matter 6:1. So what is the purpose of a substance we can't see, yet is so prevalent?

Initially, scientists and astronomers believed that gravity was slowing down the progress of the universe. However, in recent decades, data has shown that the expansion of the universe is accelerating. Understanding dark matter and dark energy are key to elucidating the reason for this increased speed in universe development. Many galaxies in the universe are rotating too fast for their gravity to be the only thing keeping them together: if that was the case, galaxies would not be able to stay intact and would fall apart. We can infer that dark matter is part of the solution.

Astronomers and scientists are still trying to figure out exactly what dark matter is made of in order to further understand its applications in space. One hypothesis is that it is made of particles such as axions or WIMPS, weakly interacting massive particles. Another introduces supersymmetric particles. Scientists might be able to study dark matter particles at the world's largest particle collider: the Large Hadron Collider, located underneath the France-Switzerland border. Dark matter particles may be large enough for the collider to produce them during collisions. While we wouldn't be able to detect them, scientists can measure their existence via the energy and momentum "missing from a collision"—the significant energy and momentum carried by the dark matter particles. If this is the case, the Large Hadron Collider could be instrumental in shining a light on these otherwise invisible space particles.

- 1. Which of the following describes dark matter?**
  - a. It is antimatter.
  - b. It is a galaxy-sized black hole.
  - c. It may help galaxies stay intact.
  - d. It appears in the form of stars and planets.
  
- 2. What makes the study of dark matter so challenging?**
  - a. Its enormous weight and density
  - b. Its lack of prevalence in the known universe
  - c. Its negative effects on visible matter
  - d. It cannot be observed or detected
  
- 3. If there were 200 particles in our universe, how many of them would we expect to be dark matter, based on the information in this article?**
  - a. 10
  - b. 27
  - c. 54
  - d. 100
  
- 4. Which of the following is not a reason why studying dark matter is important?**
  - a. It can help us understand how galaxies remain intact.
  - b. It can help us understand the process of star formation.
  - c. It significantly outweighs the visible matter in our universe.
  - d. It can help us understand how the expansion of our universe is accelerating.
  
- 5. Which of the following would be an equation scientists could use to detect the presence of dark matter in a collision at the Large Hadron Collider?**
  - a. Dark matter + total energy and momentum of a collision = 100
  - b. Total energy + total momentum = dark matter
  - c. Total energy and momentum of a collision – energy and momentum contained in the particles that collided = dark matter
  - d. Dark matter – energy missing from a collision = energy contained in the particles that collided
  
- 6. Which of the following best describes the role of the Large Hadron Collider in helping scientists understand dark matter?**
  - a. It will allow scientists to view the previously invisible dark matter particles.
  - b. It will allow scientists to manipulate the weight of the dark matter particles.
  - c. It will allow scientists to take dark matter particles across the ocean.
  - d. It will allow scientists to study dark matter in more controlled, lab conditions.

**7. Which statement is true, according to the article?**

- a. The expansion of the universe is slowing down.
- b. Dark matter is part of the visible spectrum.
- c. Dark matter may be composed of supersymmetric particles.
- d. The Large Hadron Collider is located on the Spain-Switzerland border.