

Atom: Clash of Titans

Introduction

1. What controversial idea did Ludwig Boltzmann believe in that contributed to his suicide in 1906?
2. Why was there such a demand to study the movement and behavior of water vapor during this time?
3. What surprising observation did Robert Brown make when he examined pollen grains in water under a microscope?

a. This is called _____.

4. What did Albert Einstein believe was causing the movement of the pollen grains?

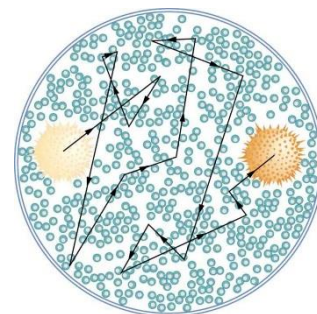
a. This proved that _____ must exist.

5. A single human hair is _____ atoms wide.
6. Compare the methods used by Ernest Rutherford and Neils Bohr for studying atoms.
7. What three important discoveries were made in the early 20th century that made it possible to unlock atoms?
 - a.
 - b.
 - c.

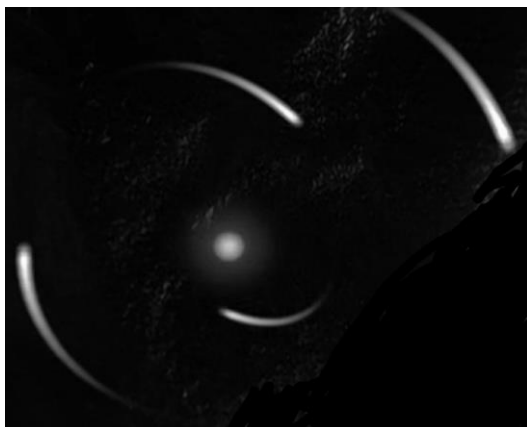
8. Give one example of an unusual property held by radioactive materials.

9. Label the **gold leaf (foil)**, **radium**, and **phosphorescent screen**.

10. What does radium emit?



11. What were the initial results of the gold foil experiment?
- a. What unusual suggestion did Rutherford have for the experiment after weeks of collecting data?
12. What fraction of alpha particles did Hans Geiger calculate bounced back towards the radium source?
13. Ernest Rutherford had discovered the _____.
14. This is what Rutherford believed the atom to look like. Label the **electrons** and **nucleus**.

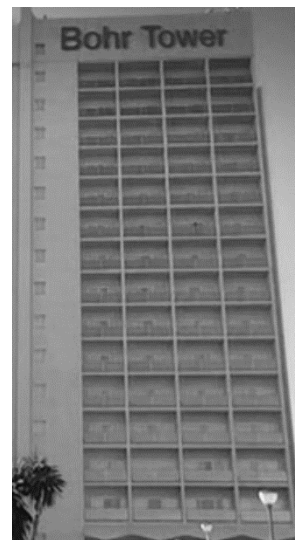


15. Why did most of the alpha particles passed straight through the gold foil?
16. If the nucleus of an atom were the size of a soccer ball, how far away would the electrons be?
17. How big would a person be if all the empty space within atoms were removed?
18. What did Neils Bohr study to solve the mystery of the empty space within atoms?

19. Spectra are colors associated with different structures. For example, what light do each of these materials make?
- a. Copper –
 - b. Sodium –
 - c. Lithium –

20. According to Neils Bohr, the electrons in an atom are more analogous to a multistory building than a solar system. What part of the atom is at the ground floor?

- a. Where are the electrons?
- b. Can electrons exist between floors?
- c. Electrons have the ability to _____ from one floor to another.



21. When an electron jumps from a higher to lower quantum, what happens?

22. Gold (solid, yellow, inert) differs from mercury (silver, liquid, toxic) by _____.

23. Summarize what Pauli's exclusion principle states about electron shells.

24. A physicist named Erwin Schroedinger showed that electrons are really _____ of _____.

25. What mathematical expression did Heisenberg use to predict the behavior of atoms?

26. What does Heisenberg's Uncertainty Principle mean regarding the speed and position of an electron?

27. Atoms can behave as _____ and _____.