Models of the Hydrogen Atom

When Newton wrote his Principia Mathematica, there was this idea of the “atom”. This term came from a Greek word meaning “not cut” as in it could not be cut down into a smaller bit. Newton, and all the other scientists thought that the atom, the basic component of matter, were like small ball bearings, bouncing off each other. This idea lasted all the way until the early 1900’s with the discovery of the electron and proton, objects smaller than an atom. This lead to a decades long discussion on the structure of the atom. Below you will research different models of the atom and explain their pros and cons.

**Thomson’s “Plum Pudding” Model:**

Description of model:

Diagram of Model:

What experiments disproved this model?

**Classical Solar System Model:**

Description of model:

Diagram of Model:

What obersvations disproved this model?

**Bohr Model of the Atom:**

Description of model:

Diagram of Model:

What experiments/observations supported this model?

**deBroglie Model of the Atom:**

Description of model:

Diagram of Model:

How is this model different from the Bohr Model?

**Schrödinger Model of the Atom:**

Description of model:

Diagram of Model:

**ORDER OF EVENTS**

**Using the numbers 1-5 (1 being the earliest), place the following atomic theories in order, according to when they were theorized.**

|  |  |  |
| --- | --- | --- |
|  | **Atoms are made up of mostly empty space. Most of the mass is concentrated in the center nucleus.** |  |
|  | **Negatively charged particles are called electrons. The atom is thought of as electrons scattered inside a positively charged mass.** |  |
|  | **Electrons exist in a region around the nucleus called the electron cloud, instead of energy levels.** |  |
|  | **Each type of matter is made up of only one type of atom. Atoms are too small to be seen.** |  |
|  | **Electrons are arranged in energy levels. The atoms resembles the solar system.** |  |

**QUESTIONS**

1. Who first suggested the concept of atoms? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

2. John Dalton said atoms were the smallest \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. The “pool ball” theory was invented by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Which scientist discovered electrons? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

5. J.J. Thomson discovered which theory? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

6. Who proved the “Cookie Dough” theory incorrect? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

7. How did the scientist from #6 prove the theory was wrong?

8. In this experiment, which part of the atom did Rutherford discover? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

10. Who came up with the “solar system” model? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

11. In the “solar system” model, which part of the atom is the “sun”? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

12. What is the model that is accepted today called? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Directions:  Put the number of the definition from the list below into the square with the appropriate term.  Check your answers by adding the numbers to see if all the sums of all rows, both across and down add up to the same number, the Magic #.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Democritus  \_\_\_\_\_ | Dalton  \_\_\_\_\_ | Thomson  \_\_\_\_\_ | Chadwick  \_\_\_\_\_\_ | Total  \_\_\_\_\_ |
| Rutherford  \_\_\_\_\_ | Proton  \_\_\_\_\_ | Atom  \_\_\_\_\_ | Bohr  \_\_\_\_\_ | \_\_\_\_\_ |
| Wave Model  \_\_\_\_\_ | Neutron  \_\_\_\_\_ | Nucleus  \_\_\_\_\_ | Alpha particle  \_\_\_\_\_ | \_\_\_\_\_ |
| Electron  \_\_\_\_\_ | Model  \_\_\_\_\_\_ | Energy levels  \_\_\_\_\_ | Electron cloud  \_\_\_\_\_ | \_\_\_\_\_ |
| Total   \_\_\_\_\_ | \_\_\_\_\_ | \_\_\_\_\_ | \_\_\_\_\_\_ |  |

                                                                                                                   Magic Number \_\_\_\_\_\_

1.      Represented by a symbol; all are found on the Periodic Table

2.      Made a mental model of the atom; Greek philosopher

3.      Used by Rutherford in his experiment; made of two protons and two neutrons

4.      The paths in which electrons circle the nucleus according to the Bohr model

5.      The positive particle in the nucleus of an atom

6.      The tiny positive core of an atom; contains protons and neutrons

7.      Formed the atomic theory model of the atom; English schoolteacher

8.      Discovered the nucleus using his gold foil experiment

9.      Current explanation of where electrons might be found in the atom

10.  Used by scientists to explain something we can not see or understand

11.  The smallest particle of an element that has the properties of that element

12.  Discovered the neutron

13.  Model of the atom; proposed by de Broglie.

14.  Mass of protons and neutrons

15.  Developed the model of the atom in which electrons orbit the nucleus in energy levels

16.  The negative particle that circles the nucleus

17.  The neutral particle in the nucleus of an atom

18.  Proposed the “plum-pudding” model of the atom; discovered the electron