

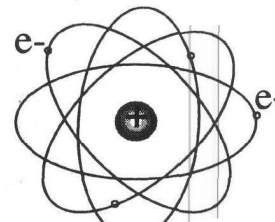


Pudding and Clouds

Five Models of the Atom

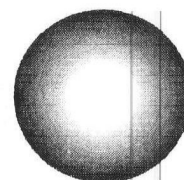
Note: The particles called electrons (e^-) are negatively charged. The protons are positively charged (+).

Model A: In this model the atom is not a solid sphere. It consists of small pieces called electrons and a dense nucleus in the center of the atom with a positive charge. The electrons circle around the nucleus. The electrons are tiny, and negatively charged while the nucleus is quite massive and positively charged. Most of the atom is empty space occupied by the electrons.



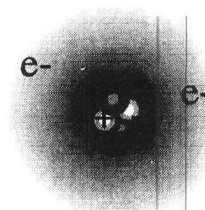
Model A

Model B: The atom is a solid sphere that cannot be divided up into smaller particles or pieces. The atom is neutral and has no charge. Atoms of the same element are made of the same types of atoms.



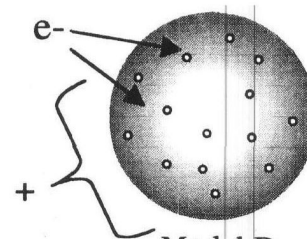
Model B

Model C: The atom consists of small pieces called electrons, protons, and neutrons. Each electron has a negative charge, each proton has a positive charge, and the neutrons are neutral and have no charge. The neutrons have a mass identical to the mass of the protons. The protons and neutrons are concentrated in the center of the atom. This center is called the nucleus. The nucleus is massive in comparison to the electrons. There is a lot of empty space between the electrons and the nucleus. The electrons are on the outer edge of the atom. The electrons are constantly moving in a cloud around the nucleus.



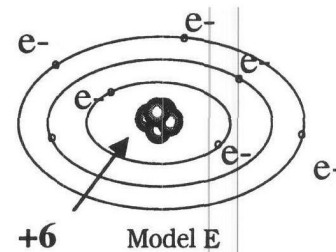
Model C

Model D: The atom is a sphere containing negatively charged particles embedded in it. These small negative pieces were originally called “corpuscles” and later called electrons. However it was also recognized that the atom is neutral (not negatively charged) so there must be an equal positive charge in the atom to offset the negative charge in the electrons. Since no other particles were known at this time the rest of the atom consisted of positively charged stuff.



Model D

Model E: In this model the atom consists of small pieces called electrons and protons. Each electron has a positive charge. The protons are concentrated in the center of the atom. The center is called the nucleus. The nucleus is massive and heavy compared to the electrons, which are really small. The electrons are located at specific distances from the nucleus. There is lots of empty space between the electrons.



Model E



Pudding and Clouds



Name: _____

Period: _____ Date: _____

Purpose: This lesson will introduce you to various models for the atom that have appeared over the past two hundred years. The descriptions of five models of the atom are on a separate handout.

In 1806, Dalton's atoms were simply solid spheres. In the decades that followed chemists collected a lot of evidence that suggested there was more to the atom. Scientists needed to come up with a more developed model, which could account for this new evidence.

Part I. Using evidence to evaluate models

Look at the five models on the handout and read the descriptions.

Here are some pieces of evidence about the atom. Compare the two models specified in the box. Decide which of the two models you are comparing best supports the evidence. Explain your reasoning.

1. It is possible to remove a negatively charged particle from an atom using electrical forces. (J.J. Thompson, 1897)

Compare models B and D.

Which model can support the evidence? Explain your reasoning.

2. If a tiny particle is shot into the middle of an atom, it hits something dense in the center and bounces back in the direction it came from. If a tiny particle is shot into the edges of the atom, it goes through. Most tiny particles shot at an atom will go through. (Rutherford, 1911)

Compare models A and D.

Which model can support the evidence? Explain your reasoning.

3. Individual atoms are not attracted to a negative charge. They are also not attracted to a positive charge. (unknown)

Compare models B and C.

Which model can support the evidence? Explain your reasoning.

4. The farther away from the center of an atom the negatively charged particles are, the easier they are to remove. (Bohr, 1913)

Compare models A and E.

Which model can support the evidence? Explain your reasoning.

5. Neutral particles can be found in the center of the atom. These neutral particles account for roughly half of the mass of the atom. (Chadwick, 1932)

Compare models A and C.

Which model can support the evidence? Explain your reasoning.

Part II. Interpreting the evidence

1. Which piece of evidence proves the existence of negatively charged particles?
2. Which piece of evidence proves that atoms are neutral?
3. Which piece of evidence supports the idea that an atom has a nucleus in the center?
4. What are the three small particles found in the atom? Cite the evidence to support your claim.

Making Sense

Examine the date of the atomic evidence and then put the five models in the correct order of their introduction to the world of science. (Sketch the models in the correct order below.)

Why do you think there were so many different models for the atom?