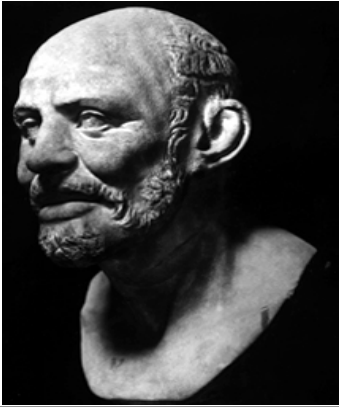
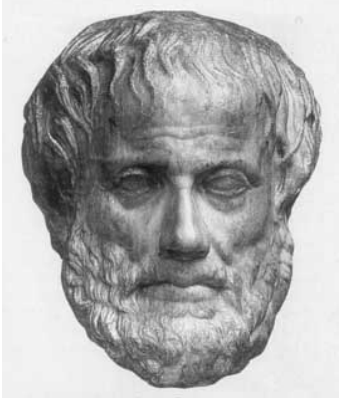



## History of the Atom

	<b>Democritus</b> 470-380 B.C.	<ul style="list-style-type: none"><li>• Democritus was known as the "Laughing Philosopher" because of his joyous spirit.</li><li>• First to suggest the idea of atoms (<i>atomos</i> - Greek "a" meaning "not" &amp; <i>tomos</i> meaning "cut"). He thought matter was composed of tiny indivisible particles - atomos.</li></ul>
	<b>Aristotle</b> 384-322 B.C.	<ul style="list-style-type: none"><li>• Aristotle spoke out against Democritus and atomism. Aristotle felt matter was continuous.</li><li>• The Catholic Church accepted Aristotle's position and came to equate atomistic ideas with Godlessness.</li><li>• In 1624, the Parliament of Paris had issued a decree that anyone holding or teaching a position opposed to Aristotle (including atomism) was liable to be put to death (needless to say, atomism didn't have a chance).</li></ul>
	<b>John Dalton</b> 1766-1844	<ul style="list-style-type: none"><li>• English school teacher (started teaching when he was only 12 years old) who became known as Father of the Atomic Theory.</li></ul> <p>Dalton's Atomic Theory :</p> <ul style="list-style-type: none"><li>• All matter is composed of indivisible particles called atoms.</li><li>• Atoms of the same element have the same physical &amp; chemical properties.</li><li>• Atoms of different elements have different physical &amp; chemical properties.</li><li>• Two or more atoms of different elements can chemically combine in simple whole number ratios to form compounds.</li><li>• Atoms cannot be subdivided, created or destroyed when involved in a chemical reaction.</li></ul>



**J. J. Thomson**  
1856-1940

- English physicist.
- Discovered the electron in 1897 after observing that the beam of light in a cathode ray tube is attracted to a positive charge and repelled by a negative charge. The electron was named years earlier by G. Johnstone Stoney but not detected until Thomson.
- In Thomson's model electrons have a negative charge but the overall charge of the atom is neutral. His model of the atom is called the Plum Pudding Model.



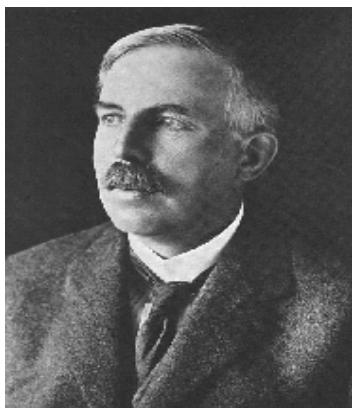
**Max Planck**  
1858-1947

- Planck was able to deduce the relationship between the energy and the frequency of radiation.
- In 1900, he announced that the energy (E) emitted by a resonator could only take on discrete values or quanta.
- $E = h\nu$  (E- energy,  $\nu$  - the frequency of the radiation, h- constant called Planck's constant,  $(6.6262 \times 10^{-34} \text{ J s})$ )



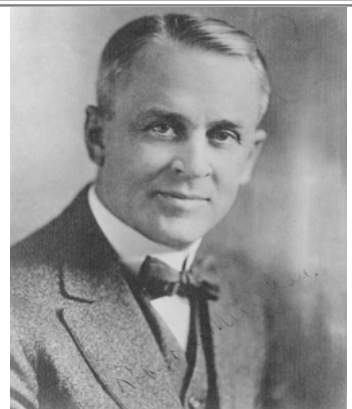
**Albert Einstein**  
1879-1955

- In 1905 used Planck's constant and proposed that light could be described as quanta of energy that behave as particles.
- Einstein used Planck's particle theory of light to explain the photoelectric effect (the release of electrons from metal when light shines on it).
- This was the first use of the Planck's theory by someone other than Planck.



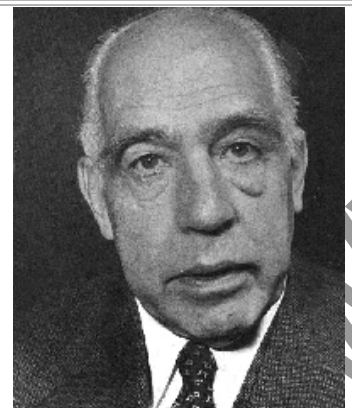
**Ernest Rutherford**  
1871-1937

- Student of J.J. Thomson.
- Conducted the gold foil experiment in 1909 when he shot alpha particles at a sheet of gold foil only 1/3000 of an inch thick.
- Rutherford expected the positively charged alpha particles to pass right through the gold foil, and most did. However, a small number of particles were deflected off at an angle and some even bounced straight back.
- Rutherford discovered that that the atom is mostly empty space and there is a small positively charged core where the bulk of its mass is located. Rutherford named this small positively charged core, nucleus (Latin, "little nut").



**Robert Millikan**  
1868-1953

- Millikan determined the charge of the electron with his oil drop experiment in 1913.



**Niels Bohr**  
1891-1973

- Student of Ernest Rutherford
- In 1913 Bohr proposed a revised atomic model. He used Planck's work to correct a flaw in Rutherford's model.
- He placed electrons into paths of definite energy circling the nucleus.
- Modeled his atomic structure after the solar system.



**Louis de Broglie**  
1892-1987

- In 1924 de Broglie discovered the wave nature of electrons.
- De Broglie solved the electrodynamic problems with Bohr's model of the atom in his 3 page Phd. submission that set out a relationship between mass velocity and wavelength.
- During World War I de Broglie served in the army. He was attached to the wireless telegraphy section for the whole of the war and served in the station at the Eiffel Tower.



**Erwin  
Schrödinger  
1887-1961**

- Schrödinger wrote and solved a mathematical equation describing the location and energy of an electron in a hydrogen atom in 1926.
- Schrödinger's equation is the current description of the electron in the atom. This mathematical model is called the quantum mechanics model or electron cloud model.



**Werner  
Heisenberg  
1901-1976**

- In 1927 Heisenberg developed his uncertainty principle which explains that it is physically impossible to measure both the exact position and the exact momentum of a particle at the same time. The more precisely one of the quantities is measured, the less precisely the other is known.
- Heisenberg's principle proved that Bohr's model of the atom is incorrect.



**James  
Chadwick  
1891-1974**

- Student of Ernest Rutherford.
- In 1932 Chadwick proved the existence of neutrons.

Name \_\_\_\_\_

**Honors Chemistry**

\_\_\_/\_\_\_/\_\_\_

**Part I: Match the name on the right with the correct statement on the left. You will use some names more than once.**

- |   |                       |
|---|-----------------------|
| 1. _____ His model of the atom is the Electron Cloud Model.   | <b>A. Aristotle</b>   |
| 2. _____ He discovered the nucleus.   | <b>B. Bohr</b>        |
| 3. _____ He put electrons into energy levels.   | <b>C. Dalton</b>      |
| 4. _____ He designed his atomic model after the solar system.   | <b>D. Democritus</b>  |
| 5. _____ He said atoms of different elements have different properties.                                       | <b>E. Rutherford</b>  |
| 6. _____ He believed that matter is continuous.   | <b>F. Stoney</b>      |
| 7. _____ He discovered the electron.  | <b>G. Thomson</b>     |
| 8. _____ He discovered that the atom is mostly empty space.   | <b>H. Schrödinger</b> |
| 9. _____ He used math to explain the location and energy of the electrons in an atom.                         | <b>I. Einstein</b>    |
| 10. _____ He is the Father of the Atomic Theory.  | <b>J. Planck</b>      |
| 11. _____ His model is called the quantum mechanics model.  | <b>K. Heisenberg</b>  |
| 12. _____ He fixed Rutherford's model.  | <b>L. de Broglie</b>  |
| 13. _____ He used polonium and gold foil in his famous experiment.  | <b>M. Millikan</b>    |
| 14. _____ He used a cathode ray tube to make his discovery.   | <b>N. Chadwick</b>    |
| 15. _____ He discovered the neutron.  |                       |
| 16. _____ He used the term "atomos" to describe an indivisible part at the base of all matter.                |                       |
| 17. _____ He named the electron.  |                       |
| 18. _____ He wrote that atoms of different elements combine to form compounds in a simple whole number ratio. |                       |
| 19. _____ He discovered the wave nature of the electron.  |                       |
| 20. _____ He designed a mathematical equation for the model of the atom.                                      |                       |
| 21. _____ He determined the charge of the electron.   |                       |
| 22. _____ He deduced the relationship between the energy and frequency of radiation.                          |                       |
| 23. _____ He proposed that light could be described as quanta of energy that behave as particles.             |                       |

**Part II: Write the last name of the atomic theorist that answers each of the following questions.**

1. \_\_\_\_\_ Which scientist is responsible for the quantum mechanics model?
2. \_\_\_\_\_ Which scientist used a cathode ray tube and a magnet in his famous experiment?
3. \_\_\_\_\_ Who designed the "Plum Pudding Model" of the atom?
4. \_\_\_\_\_ Who developed the formula  $E=h\nu$ ?

5. \_\_\_\_\_ Who is called the Father of the Atomic Theory?
6. \_\_\_\_\_ Who discovered the nucleus?
7. \_\_\_\_\_ Who wrote, "all matter is made up of indivisible, indestructible atoms"?
8. \_\_\_\_\_ Who put electrons in energy levels?
9. \_\_\_\_\_ Who discovered the electron?
10. \_\_\_\_\_ Who discovered that the atom is mostly empty space?
11. \_\_\_\_\_ Which scientist determined the charge of the electron?
12. \_\_\_\_\_ Which scientist proved the existence of neutrons?
13. \_\_\_\_\_ Who designed his model of the atom after the solar system?
14. \_\_\_\_\_ Who used Planck's constant to show how light can behave as a particle?
15. \_\_\_\_\_ Who is the first to write an atomic theory based upon experimentation?
16. \_\_\_\_\_ Who wrote that it is impossible to know exactly both the location and velocity of a particle at the same time?
17. \_\_\_\_\_ Who discovered that the nucleus has a positive charge?
18. \_\_\_\_\_ Who claimed that atoms of the same element have the same physical and chemical properties?
19. \_\_\_\_\_ Who was able to deduce the relationship between energy and frequency of radiation?
20. \_\_\_\_\_ Which theorist would NOT have been considered an atomist?
21. \_\_\_\_\_ What is the name of J.J. Thomson's model of the atom?
22. \_\_\_\_\_ Who was the first to suggest the idea of atoms?
23. \_\_\_\_\_ Whose atomic model consisted of negatively charged electrons inside an overall neutral atom?
24. \_\_\_\_\_ Who discovered the wave nature of the electron?
25. \_\_\_\_\_ Who used Planck's ideas to improve upon Ernest Rutherford's atomic model?
26. \_\_\_\_\_ Which scientist performed the "oil drop experiment"?
27. \_\_\_\_\_ Who developed the first mathematical model of the atom?
28. \_\_\_\_\_ Who discovered that energy emitted by a resonator could only take on discrete values?
29. \_\_\_\_\_ Who proclaimed that atoms cannot be subdivided, created or destroyed when involved in chemical reactions?

At the completion of this assignment you will be prepared to take the following Chapter 2 on-line quizzes:

- atomic theory scientist photo quiz 1
- atomic theory scientist photo quiz 2
- atomic theory scientist quiz 1
- atomic theory scientist quiz 2
- atomic theory scientist quiz 3