Webquest: Atomic Theories and Models

Answer these questions on your own, USING COMPLETE SENTENCES where appropriate (most of the questions, except tables and drawings). If you require more space, please complete on another piece of paper.

Atom Basics: Go to: [http://www.chemtutor.com/struct.html](http://www.chemtutor.com/struct.html) and read the “And you thought you were strange” section to answer the following questions (put answers in the table).

1. What are the three subatomic particles that all atoms are made of?
2. Where are each of the three particles located within the atom?
3. What is the electrical charge of each particle?

<table>
<thead>
<tr>
<th>1. The 3 subatomic particles</th>
<th>2. Location within the Atom</th>
<th>3. Electrical Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrons</td>
<td>Shells/Orbital’s around Nucleus</td>
<td>Negative</td>
</tr>
<tr>
<td>Protons</td>
<td>Nucleus</td>
<td>Positive</td>
</tr>
<tr>
<td>Neutrons</td>
<td>Nucleus</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

Early Ideas About Atoms: Go to [http://galileo.phys.virginia.edu/classes/252/atoms.html](http://galileo.phys.virginia.edu/classes/252/atoms.html) and read the section on “Early Greek Ideas” in order to answer the following questions:

4. What was the “basic idea” about matter that Leucippus and Democritus proposed?
The basic idea was that if you could look at matter on smaller and smaller scales (which they of course couldn't) ultimately you would see individual atoms - objects that could not be divided further (that was the definition of atom).

5. How did they use atoms to explain different physical properties?
The different physical properties -- color, taste, and so on -- of materials came about because atoms in them had different shapes and/or arrangements and orientations with respect to each other.

6. How were the ideas of these two men received by Aristotle, and what was the result on the progress of atomic theory for the next 2,000 years?
350 B.C - Aristotle modified an earlier theory that matter was made of four “elements”: earth, fire, water, air. This gave rise to the alchemists (who searched for a way to turn lead to gold).

John Dalton’s Atomic Theory: Go to [http://www.iun.edu/~cpanhd/C101webnotes/composition/dalton.html](http://www.iun.edu/~cpanhd/C101webnotes/composition/dalton.html) and use the information there to answer the following questions:

7. When did Dalton form his Atomic Theory?
Dalton publish is Atomic Theory in 1808.

8. What are the four components of Dalton’s Atomic Theory?
1) All matter is made of atoms. Atoms are indivisible and indestructible. 2) All atoms of a given element are identical in mass and properties. 3) Compounds are formed by a combination of two or more different kinds of atoms. 4) A chemical reaction is a rearrangement of atoms.
J.J. Thomson and the Electron:
Go to http://www.chemheritage.org/classroom/chemach/atomic/thomson.html and use the information there to answer the following questions:

9. What is the year in which J.J. Thomson discovered the electron?
In 1897 the British physicist Joseph John (J. J.) Thomson discovered the electron.

10. What was the evidence for “bodies much smaller than atoms”?
Thomson in a series of experiments designed to study the nature of electric discharge in a high-vacuum cathode-ray tube, an area being investigated by numerous scientists at the time. He interpreted the deflection of the rays by electrically charged plates and magnets as evidence of "bodies much smaller than atoms" that he calculated as having a very large value for the charge-to-mass ratio. Later he estimated the value of the charge itself.

11. What was the model of the atom he proposed in 1904?
In 1904 Thomson suggested a model of the atom as a sphere of positive matter in which electrons are positioned by electrostatic forces. It is called the Plum Pudding Model.

Rutherford and Bohr Break the “Plum Pudding” Model: Go to http://www.pbs.org/wgbh/aso/databank/entries/dp13at.html and use the information found there to answer the following questions:

12. What was the “plum pudding” model of the atom and its electrons?
"Plum pudding,” that is, it was roughly the same consistency throughout, with negatively-charged electrons scattered about in it like raisins in a pudding.

13. How much smaller was the nucleus, than the atom itself, according to Rutherford?
After tracing many particles and examining the patterns, Rutherford deduced that the atom must have nearly all its mass, and positive charge, in a central nucleus about 10,000 times smaller than the atom itself.

14. How did Bohr modify this model of the atom (i.e. what was his “revolutionary idea” about electrons)?
Bohr suggested the revolutionary idea that electrons "jump" between energy levels (orbits) in a quantum fashion, that is, without ever existing in an in-between state. Thus when an atom absorbs or gives off energy (as in light or heat), the electron jumps to higher or lower orbits.

Chadwick (and Rutherford) and the Neutron: Go to http://www.pbs.org/wgbh/aso/databank/entries/dp32ne.html and use the information found there to answer the following questions:

15. What makes up the atomic number?
The Protons in the Nucleus.

16. What makes up the atomic mass?
The Neutron and Protons in the Nucleus.

17. What observation led Chadwick (and Rutherford) to conclude there must be something besides just the proton in the nucleus of atoms?
Using an experimental method for tracking particle radiationHis experiments were successful. He was able to determine that the neutron did exist and that its mass was about 0.1 percent more than the proton's.

18. What is the something-besides-just-the proton called?
It was called a Neutron.
History of the Atom Timeline

Click the following link: http://atomictimeline.net/index.php Use the information in this web page to fill in your History of the Atom Timeline. Use the following clues to help you. Make sure that all of the dates and all of the inventors are filled in.

**Hints**

1. My famous quote was disputed by Aristotle, although time proved me correct.
2. In what date was it determined that matter can neither be created nor destroyed. Name the date and the scientist.
3. Name the date and inventor of the modern version of the Atomic Theory.
4. I was born in 1831 and showed that electricity and magnetism are scientifically related.
5. He developed the plum pudding model and also was the first to discover the **Electron**.
6. In 1909 this scientist demonstrated that the atom is mostly empty space with a small positively charged nucleus containing most of the mass and low mass negatively charged particles orbiting this nucleus. He was also credited with naming **alpha and beta radiation/particles**.
7. What date did Neils Bohr developed the first successful model of the atom?

### History of the Atom Timeline

<table>
<thead>
<tr>
<th>Discovery</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>400 BC</td>
<td>1785</td>
<td>1808</td>
<td>1831</td>
<td>1904</td>
<td>1909</td>
<td>1922</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Inventor:</th>
<th>Democritus</th>
<th>Antoine Laurent Lavoisier</th>
<th>Dalton</th>
<th>Michael Faraday and Joseph Henry</th>
<th>Joseph John Thompson</th>
<th>Ernest Rutherford</th>
<th>Bohr</th>
</tr>
</thead>
</table>

HONOR CODE: On my honor, I have neither given nor received unauthorized assistance on this assignment. This work is 100% completed by myself and was not shared with any other students.

Signature: ___________________________________________