NAME ______________________ Mail ____

NAME ______________________ Date____

NAME ______________________ Per ____

History of the Atom Model Matching Activity Orange Text Prep 14-2

1. DO NOW, THINK NOW – Debate/ discuss with neighbor
What do you imagine has happened to the model of atoms has scientific understanding has progressed? Use the term simplicity and complexity.

2. Next in assigned groups, debate with lab partner(s) & try to arrange the various historic to present day models of atoms (see cards) in the proper order.
(CHECK with Mr. Burns when you think you got it.)

3a. READ about the philosophy, the chemist and each physicist. Try and match them to the various models of atoms, historic to present day. Each one made contributes that furthered present day understanding and paved the way for scientists that came after them.

When you are satisfied you have the proper order, list them below in the boxes. Left -> Right

← WRITE 7 LETTERS of <u>ATOM MODELS</u> HERE

3b. Arrange the scientists in the proper order. Check that this is corresponds with the order of the models above. See Extend on back.

Match the proper scientist to their proper model.

Thomson's Model	1.	
Bohr's Model	2.	
Dalton	3.	
Cloud Model	4.	
Quantum Mechanics Model	5.	
Rutherford's Model	6.	
Democritus	7.	

← WRITE 7 Letters (A-G) here again.

Hint: double check the order of the scientists with the order of models.
Does this order match your hypothesis for the models. Adjust your answers if need be.
Do these match the order of the models, because they should.
Extend:

List the names of models in proper historic order with the model LETTER indicator.	**A-G**

Democritus

The first person to suggest the idea of atoms is credited to a Greek philosopher named Democritus. More than 2400 years age, Democritus asked whether it is possible to divide a sample of matter forever into smaller and smaller pieces. After much thought, he concluded that it was not. At some point, a smallest piece would be reached. In fact, the word "atom" comes from the Greek word *atomos*, meaning "cannot be divided." Democritus and his students did not know what scientists today know about atoms. However, they hypothesized that atoms were small, hard particles that were all made out of the same material.

Dalton

In the early 1800s a man John Dalton, an English chemist, weather observer and discoverer of colorblindness among other things, did some careful experiments involving matter and mass. Based on his observations he came up with the Atomic Theory of Matter. It changed little in regard to the development of the model of the atom, but it took physics and chemistry beyond just philosophy and into the realm of true scientific endeavor. He identified for the first time elements by atomic mass. Dalton's "rule of greatest simplicity" caused him to assume that the formula for water was OH and ammonia was NH, quite different from our modern understanding (H_2O, NH_3). On the other hand, his simplicity rule led him to propose the correct modern formulas for the two oxides of carbon (CO and CO_2). Despite the uncertainty at the heart of Dalton's atomic theory, the principles of the theory survived. Dalton published his first table of relative atomic mass containing six elements (hydrogen, oxygen, nitrogen, carbon, sulfur and phosphorus), relative to the weight of an atom of hydrogen conventionally taken as 1.

Thomson's Model

The first scientist to suggest that atoms contain smaller particles was J.J. Thomson of England. In 1897, Thomson passed an electric current through a gas. He found that the gas gave off rays made of negatively charged particles. Today these particles are known as electrons. Because the electrons were negative and atoms were known to be neutral, Thomson reasoned that there must also be some positive charge holding the atom together. Thomson hypothesized that an atom is made up of mostly positively charged material with electrons scattered evenly throughout. His model often referred to as the plum pudding model.

Rutherford's Model

In 1908, a scientist from New Zealand named Ernest Rutherford performed an experiment to test Thomson's atomic model. Rutherford was Thomson's understudy and discovered that an atom is mostly empty space. He did this by firing alpha particles at thin sheets of gold foil. If the nature of the atom were solid, the particles should bounce back. They did not, and most simply passed right through as though nothing were there at all. Occasionally some the alpha particles ricocheted wildly in one direction or another. He concluded that they must have struck a small dense central core. The nucleus had been discovered.

Bohr's Model

Rutherford's model of the atom did not explain the arrangement of electrons. In 1913, the Danish scientist Neils Bohr, working under Rutherford proposed that electrons in an atom are found in discrete energy levels. Each energy level is at a certain distance from the nucleus. Electrons in different energy levels move around the nucleus in different orbits, much as the planets move in orbits around the sun. Bohr was drawn to this conclusion after careful observations and consideration. His theory had strong opposition however, at the time and opponents of it often pointed to the fact that electrons were known to be negative and the nucleus positive. Why do electrons not spiral down into the nucleus? Shouldn't oppositely charged particles be attracted to one another?

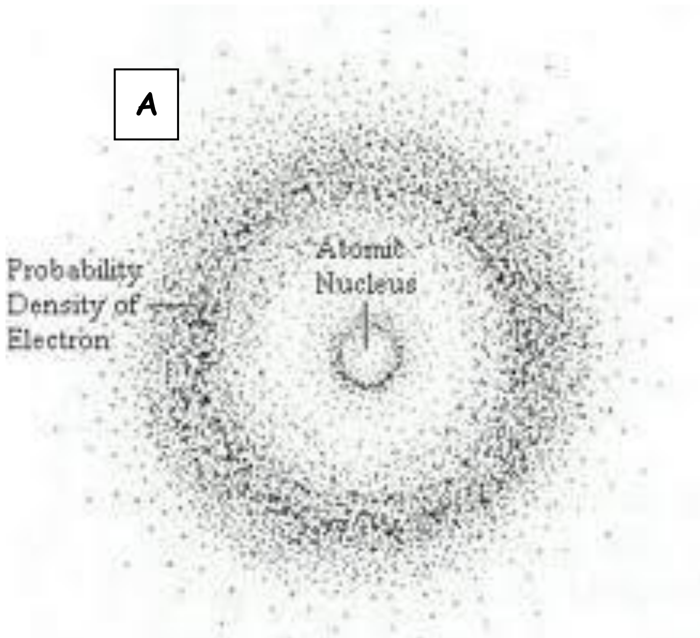
Cloud Model

Scientists now know that the exact location of an electron cannot be predicted. Instead, energy levels are used to predict the place where an electron is most likely to be found outside the nucleus. This area is often called the electron cloud. Within this cloud are distinct shells in which electrons reside. The heavier the atom, like Uranium, the more shells it has. Like layers of an onion, one shell staked on top of another. The shells are typically modeled as spherical and each spherical shell has subshells. As an atom gains energy, electrons climb higher through the cloud layers or shells. During the period of debate that much of this was all being hashed out it was common to simply depict the electron as a cloud of sorts around a nucleus.

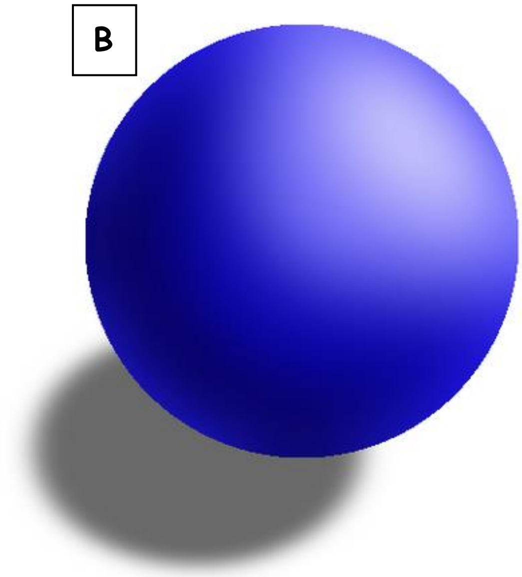
The Quantum Mechanics Model

Uses complex shapes of orbitals (sometimes called electron clouds) which occupy distinct volumes of space in which there is likely to be an electron. This model is based on probability rather than certainty. Scientists now believe that as we move up the Periodic Table and atoms increase in atomic number & number of electrons, all sorts of bizarre geometric patterns around the nucleus start to arise rather than simply spheres. The physicist Neils Bohr truly paved for the way with his model of discrete electron energy levels to present day models of quantum mechanics.

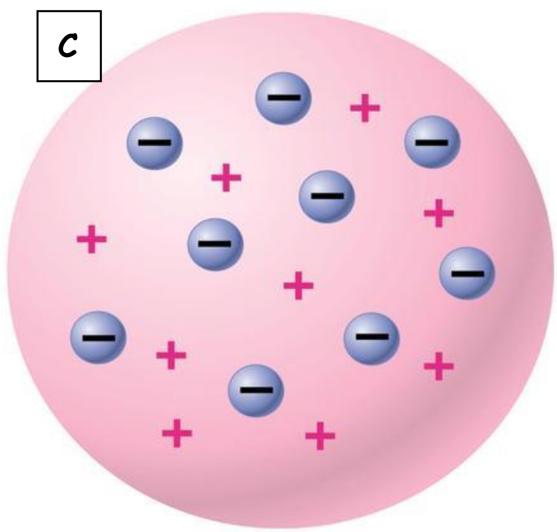
A


Probability Density of Electron
Atomic Nucleus

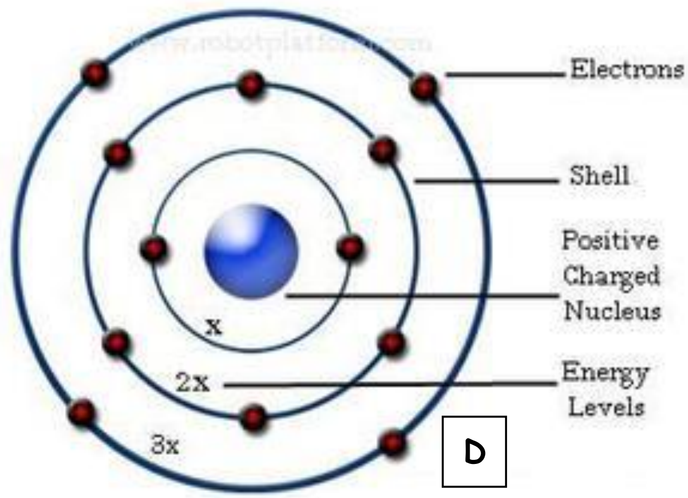
B



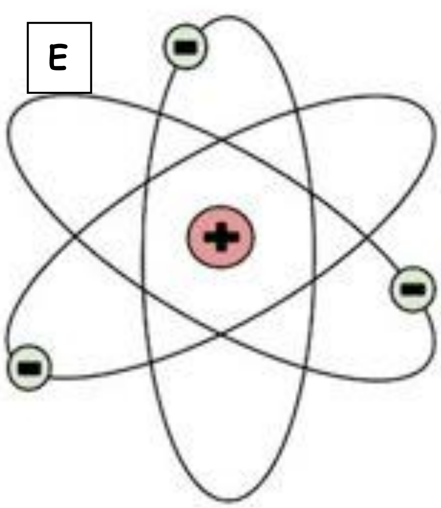
C



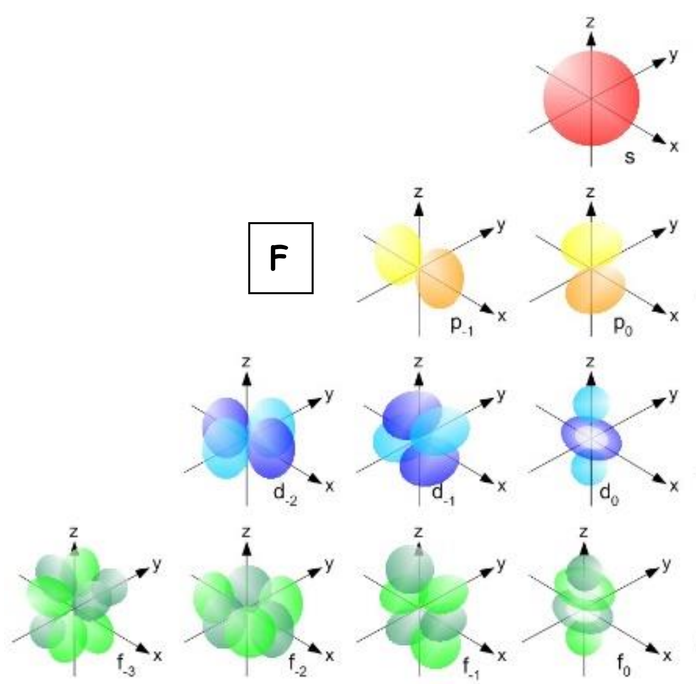
D


Electrons
Shell
Positive Charged Nucleus
Energy Levels
x
2x
3x

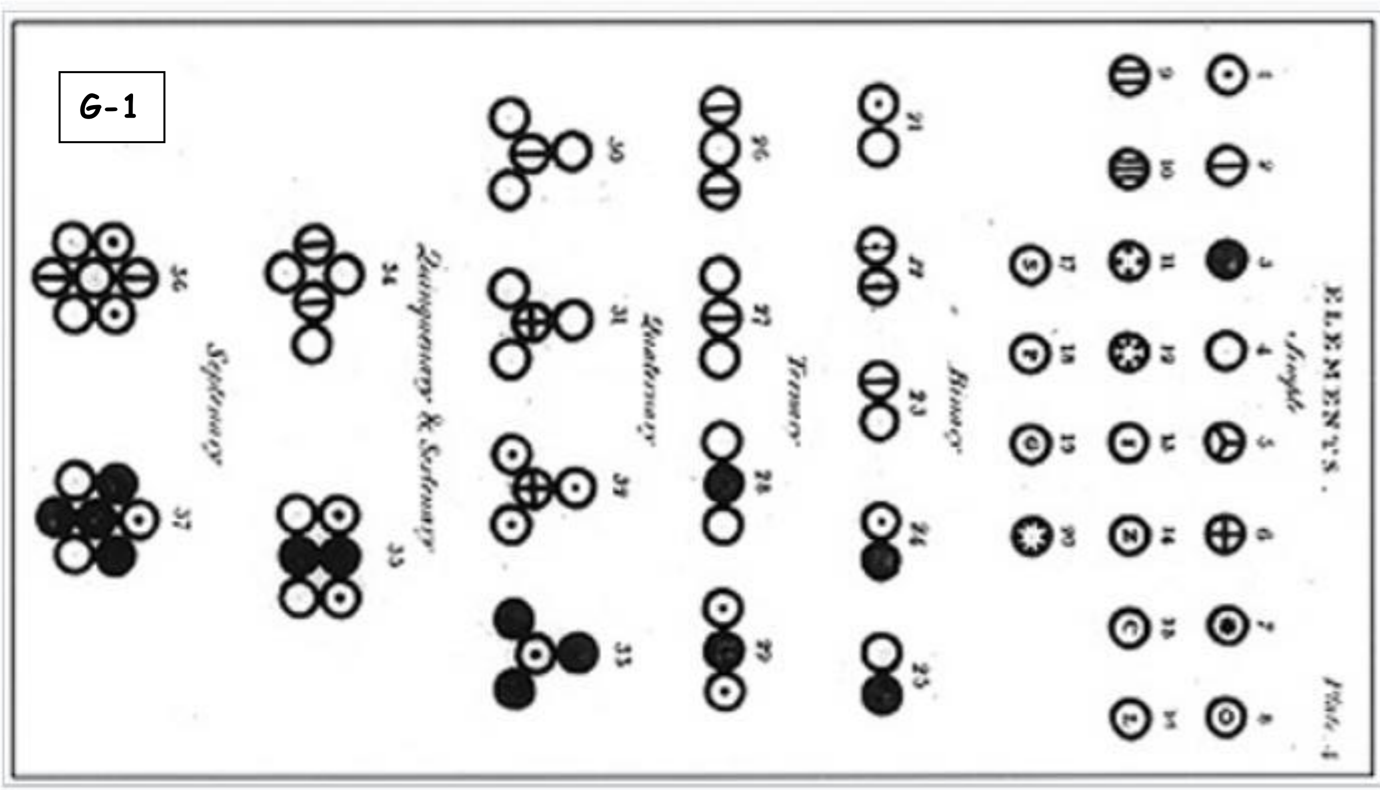
E



F


s
p-1
p0
d-2
d-1
d0
f-3
f-2
f-1
f0

G-1


ELEMENTS
Simple
Binary
Ternary
Quaternary
Quinquenary & Sextenary
Septenary

G -2


ELEMENTS
Wt
Hydrogen 1
Azote 5
Carbon 54
Oxygen 7
Phosphorus 9
Sulphur 13
Magnesia 20
Lime 24
Soda 28
Potash 42
Wt
Strontian 46
Barytes 68
Iron 50
Zinc 56
Copper 56
Lead 90
Silver 190
Gold 190
Platina 190
Mercury 167