

Name: _____ **Date:** _____ **Period** _____

The atomic model play

Student 1 – Dr. Peters, could we please go over the history of atomic theory again, I want to make sure I have reviewed for the quiz Wednesday!!

Dr. Peters – of course!!! Why don't we start at the beginning then?

Student 1 – That would be great!!!

Dr. Peters – Who knows which Greek philosopher proposed the first theories of what atoms looks like?

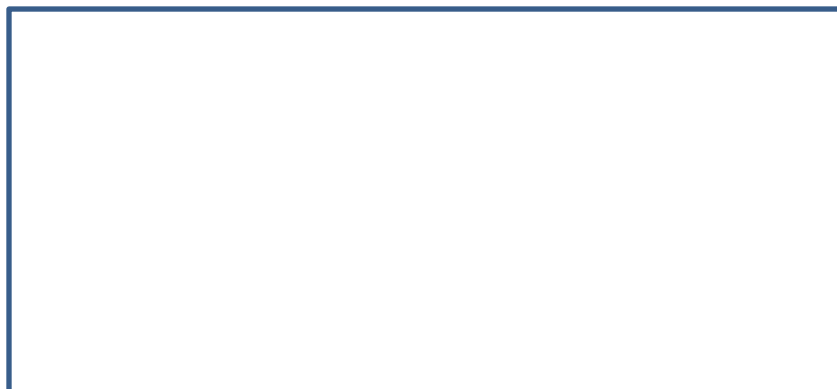
Student 2 – I know this one!!! It was _____.

Dr. Peters – Yes – Democritus hypothesis was that atoms were tiny quantities of _____ . He also believed that atoms could not be created nor _____ . He stated that atoms were _____ or could not be broken down. He added that in between atoms are _____ spaces. The more empty space, the _____ the atom gets. Can anyone tell me what the Democritus Atomic Model looked like?

Student 3 – I can – The Democritus atom was shaped like a _____

Dr. Peters – That is right – Can anyone draw the Democritus Atom on the board?

Student 4 – I can -



Dr. Peters – That is great!!!! The next person we discussed was John Dalton. Dalton also proposed the theory that all matter was made up of particles called _____ . Can anyone tell me anything about Dalton’s atomic theory?

Student 1 – I think I know, in the models of atoms based on Dalton’s theory, the elements are solid _____. Each type of atom is represented by a tiny, solid sphere, where each sphere has a different _____.

Student 2 – Wasn’t Dalton the guy that said that all atoms of the same element have the same _____?

Dr. Peters – Yes!!! Dalton’s theories postulated that all _____ are composed of atoms, of which the atoms of the same element have the same _____, and atoms of different elements have different _____. Compounds therefore contain more than one element. In a particular compound, atoms of different elements always _____ in the same way. Dalton performed experimentation showing the masses of compounds containing known elements to show data that supported his theories. Over time, scientists found that _____ all of Dalton’s ideas were correct and Dalton’s model was revised.

Student 3 – Can I draw a picture of Dalton’s atom model on the board??? Please !!!

Student 4 – Awe – I wanted to draw the model!!!

Dr. Peters – Go ahead and draw the Dalton model (nods to Student 3) – (looking at student 4) you could draw out the next model. Do you know who the next scientist we are going to talk about?

Student 4 – Thompson!!!

Student 3 –



Dr. Peters – That is great!!!

Dr. Peters – ok – It is time to talk about J.J. Thomson and his

_____ model of the atom. JJ Thomson used an

_____ current to learn more about the structure of atoms.

Student 1 – That’s the guy with the _____ ray.

Dr. Peters – (Looking at Student 4) could you tell me what the device looked like and what it would do?

Student 4 – OK – I think I can describe it – but I am not sure –

Dr. Peters – Don’t worry the class will help you out if you need it. Right class???

Class – (in unison a gleeful agreement) YES!!!

Student 4 – OK – In Thomson’s experiment, he used a device - at the center of the device

there was a sealed glass tube from which most of the _____ could be

removed. At each end of the tube there were _____ disks with

_____ connecting the disks. The wires are attached to an electronic

current.

Dr. Peters – THAT IS RIGHT !!!! GREAT JOB!!!

Dr. Peters - When the current is on, one disk becomes positively charged and the other disk becomes

Class - _____ charged.

Dr. Peters - You guys are doing great!!! Ok - so when this happens a _____ appears in the space between the disks. Thomson hypothesized that the beam was a stream of charged particles that interacted with the air in the tube and caused the air to "glow".

Student 1 - That is where I get lost - Why did you hypothesize that?

Student 2 - I don't understand this part either.

Student 4 - I know this!!! - In his experiments, Thomson placed a pair of _____ plates on either side of the glass tube. The plates caused the beam to _____, or bend, from its straight path. Thomson observed that the beam was repelled by the negatively charged plate and attracted by the _____ charged plate.

Dr. Peters - Yes, so Thomson concluded that the particles in the beam had a _____ charge because they were attracted to the positive plate. He hypothesized that the particles came from inside atoms. This was supported by two pieces of experimental evidence. Does anyone remember what the two pieces of evidence were

Student 3 - I know one of them. No matter what _____ Thomson used for the disk, the particles produced were identical.

Dr. Peters - Yes and the second was that The particles had about $1/2000^{\text{th}}$ the mass of a hydrogen atom, the lightest atom. Thomson's discovery changed how scientists thought about atoms (remember previous models were thought to be solid balls. Thomson's experiments led to theories that atoms are made of even smaller _____).

Dr. Peters - So what did Thomson's model look like, can anyone describe it to me?

Student 2 - Atoms are _____ - meaning they have neither negative nor positive charges. _____ charges are scattered around a positively charged mass of matter, this was named the “_____pudding model”. Think of a scoop of chocolate chip ice cream, where the chips are _____particles that are spread evenly through a mass of _____ charged matter which is represented by the vanilla ice cream.

Dr. Peters – That is great – you can draw the picture now....

Student 4 –



Dr. Peters – Great Job!!!!

Dr. Peters – Now let’s talk about Ernest Rutherford. Rutherford was the first to discover the _____particle. The particle is a _____ charged fast moving particle. In 1909 Rutherford had one of his students, Ernest Marsden, to perform an experiment to explore what happens when alpha particles are passed through gold sheets. Remember in Thompson’s model, an atom was composed of a mass of _____ charge even spread throughout the atom. What did Rutherford hypothesize?

Student 2 - Rutherford hypothesized that the mass and charge at any location in the _____ would be too small to change the path of an alpha particle (a fast moving positive particle). He predicted that most particles would travel in a _____ path from their source to a screen that lit up when they struck it. Those few that did not pass straight through would be deflected only slightly.

Dr. Peters - That is right, Marden aimed a narrow beam of alpha particles at the gold. The screen around the gold was made of a material that produced a flash of light when struck by the fast-moving positive alpha particles. By observing the flash, Marden could figure out the path of an alpha particle after it passed through the gold. Based on Thompson's model, Rutherford expected that the many alpha particles would penetrate straight through the atoms striking the detecting screen.

Student 1 - Yes, but the experiment did not support this hypothesis.

Student 4 - But he was wrong right?

Student 2 - Ya that is right he was wrong - wait - I mean - more particles were deflected than expected. About one out of every 20,000 was deflected by more than 90 degrees. Some of the alpha particles behaved as though they had struck an object and bounced straight back.

Dr. Peters - that is right, the alpha particles whose paths were deflected must have come close to another charged object. The closer they came, the greater the deflection was. But many alpha passed through the gold without being deflected. From these results, Rutherford concluded that the _____ charge of an atom is not _____ spread throughout the atom. It is concentrated in a very small, central area that Rutherford called the

Class - _____ .

Dr. Peters – and what is the plural of nucleus?

Class - _____ .

Dr. Peters – And in Rutherford’s atomic model, the nucleus is a dense _____ charged mass located in the center of the atom. Can anyone summarize the Rutherford model of the atom and how the evidence from the experiment supported Rutherford’s Atomic Model?

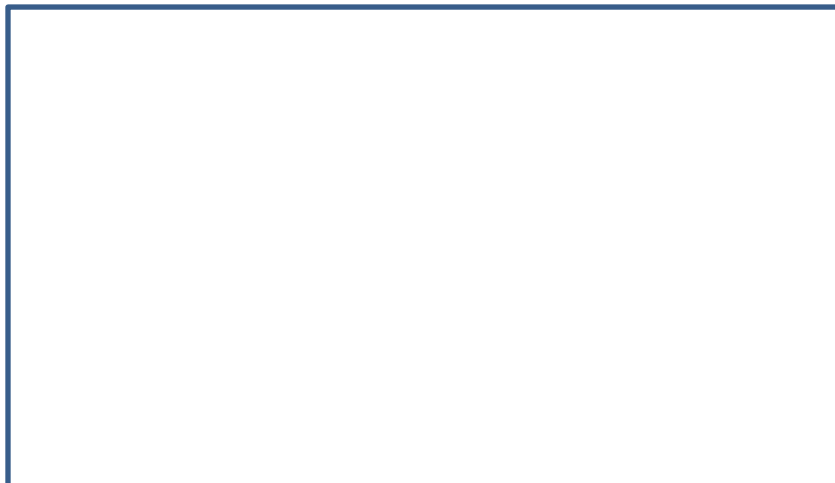
Student 1 – In Rutherford’s model all of the atoms positive charge are concentrated in the center of the atom.... So in the experiment, the _____ particle whose paths were deflected by more than 90 degrees came very _____ to a nucleus. The alpha particles whose paths were not bent moved through the space surrounding the nuclei without coming very close to the nucleus.

Dr. Peters: GREAT JOB!!!

Student 2: Can I please draw that model on the board?

Dr. Peters: Sure!!!

Student 2:



Student 4: Dr. Peters how big is a nucleus then? It must be really small right?

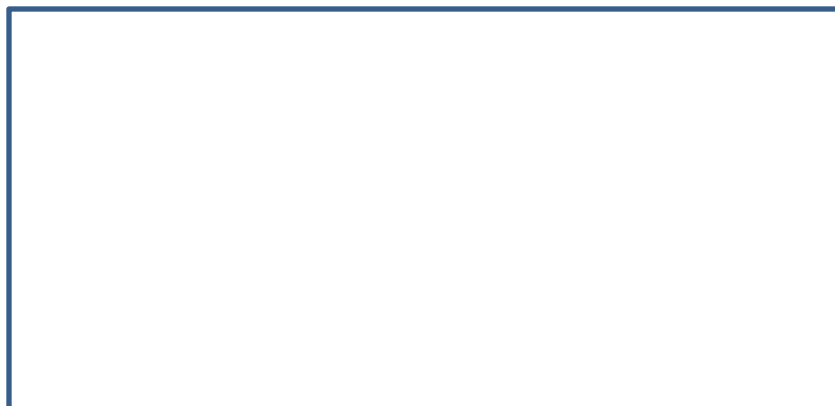
Dr. Peters: That is right, the nucleus is relatively small... imagine the Houston Astrodome which is nine acres and seats more than 60,000 people. The roof of the stadium rises to a height of 202 feet above the center of the field. If an atom has the same volume as the stadium, the nucleus would have the volume of a marble. The total volume of an atom is about a trillion times the volume of a nucleus. So the nucleus is really small.

Dr. Peters: Are there any other questions?

Student 3: Ohh Dr. Peters we forgot to go over Bohr...

Dr. Peters: Thank you for reminding me. Well then, in 1913, Niels Bohr, depicted the atom as a small, positively charged nucleus surrounded by electrons that travel in circular orbits around the _____—similar in structure to the solar system, but with electrostatic forces providing attraction, rather than gravity. This was an improvement on the earlier models we talked about. The Bohr model is a quantum-physics–based modification of the Rutherford model; many sources combine the two, referring to the **Rutherford–Bohr model**.

Student 1: It is my turn to draw the Rutherford – Bohr model on the board.



Dr. Peters – you all are really doing great!!! –I think your very ready for the quiz on Wednesday which will look like the chart we completed