

CHEMISTRY 11 – EARLY MODELS OF THE ATOM WORKSHEET

- 1) Match each scientist (Dalton, Thomson, Rutherford & Bohr) to the statements describing his contribution to the atomic theory. Identify who was the first person to propose the idea or make the discovery. Each scientist may be used more than once.
- a) Atoms cannot be created, destroyed or divided into smaller particles. Dalton
 - b) Discovered the nucleus. Rutherford
 - c) Electrons occupy specific energy levels or shells. Bohr
 - d) Most of the mass of the atom is in the tiny, dense, positively charged nucleus. Rutherford
 - e) Most of the atom is empty space. Rutherford
 - f) Proposed the “billiard ball” model of the atom. Dalton
 - g) All matter is made of small particles called atoms. Dalton
 - h) All atoms of the same element are identical. Dalton
 - i) Atoms contain negatively charged particles. Thomson
 - j) The nucleus contains positively charged particles called protons and particles with no electric charge called neutrons. Rutherford
 - k) Different elements combine together to form compounds. Dalton
 - l) Discovered the electron. Thomson
 - m) Electrons move around a central nucleus. Rutherford
 - n) Proposed the “plum pudding” model of the atom. Thomson
 - o) Atoms of one element are different from the atoms of other elements. Dalton
 - p) Electrons give off or absorb energy when they moved from one orbit to another. Bohr
 - q) Observed streams of negatively charged particles in gas discharge tubes. Thomson
 - r) Discovered the neutron. Rutherford
 - s) Compounds are created when atoms of different elements link together in specific ways. Dalton
 - t) Discovered the proton. Rutherford
 - u) The number of electrons surrounding the nucleus equals the number of protons in the nucleus. Rutherford

- 2) The ancient Greek view of nature was based on an experimental approach to acquiring knowledge. Support or contradict this statement.

This statement would be contradicted since the Greek view of nature assumed that experimental work could be misleading and that philosophy should be used.

- 3) Suggest a possible reason why most investigations of the alchemists were concerned with the separation of metals from ores.

Alchemists were concerned with metals since they were immediately recognizable, valuable and useful in everyday life.

- 4) How did the work of Dalton allow an expansion of chemical manufacturing?

Dalton's work allowed the composition of chemicals to be known more accurately and compounds to be made efficiently without wasting reactants.

- 5) The term "berthollide" describes a compound in which the amounts of the elements present change over a substantial range. For example, samples of FeS may actually have formulas such as $\text{Fe}_{0.943}\text{S}$ or $\text{Fe}_{0.896}\text{S}$. Such compounds were unknown in Dalton's time. Which, if any, of the Laws of Definite Proportions, Multiple Proportions and Conservation of Mass are violated by the existence of the berthollides?

Law of Definite Proportions

- 6) Show that the following four oxides of nitrogen obey the Law of Multiple Proportions.

Compound #	Mass of N (g)	Mass of O (g)	Ratio
1	0.3160	0.0903	1
2	0.3160	0.3611	4
3	0.3160	0.7223	8
4	0.3160	0.5417	6

The last column in the above table gives the result of dividing the mass of oxygen in each compound by the mass of oxygen consumed in compound #1. Based on these ratios the formulas of the compounds would be NO (compound 1), NO_4 (compound 2), NO_8 (compound 3) and NO_6 (compound 4).

- 7) Why did Rutherford's discovery of the atomic nucleus cause Thomson's "plum pudding" model of the atom to be abandoned?

The "plum pudding" model assumed that the protons and electrons were uniformly distributed throughout the volume of the atom. When Rutherford found the nucleus consisting of almost all the mass, Thomson's ideas were abandoned.

- 8) What problem did the discovery of the neutron solve?

Rutherford had found the presence of protons in the nucleus could account for the charge on the nucleus but it could not account for all of the mass present in the nucleus. The idea and discovery of the neutron solved this problem.

9) Does the Rutherford atomic model conflict with Dalton's atomic theory? Explain your answer.

Dalton's model is not in conflict with Rutherford's model because Rutherford accepted the idea that atoms exist and concerned himself with the internal structure of the atom. Dalton was concerned with the properties of the atoms and how they combined together.

10) According to Rutherford's model of the atom, what existed in the nucleus of the atom?

Rutherford suggested that protons existed in the nucleus, but he suspected that some particle like the neutron existed in the nucleus as well.