Atomic theory

Science, Physics

1. a) Democritus reasoned that if matter could be infinitely divided, it was also subject to complete disintegration from which it can never be put back together. However, matter can be reintegrated. b) In Greek, the prefix " a" means " not" and the word " tomos" means cut. Our word atom therefore comes from atomos, a Greek word meaning uncuttable. All matter is composed of atoms, which are bits of matter too small to be seen. These atoms CANNOT be further split into smaller portions. 2. At this point, the atomists entered into what their predecessors had postulated to be the origin of matter, namely water (Thales), air (Anaximenses), fire (Heraclitus) and earth (Empedocles). They said, quite accurately as we know today, that these four elements are not primordial substances, but are composed of atoms like everything else. 3. — All matter consists of tiny particles called atoms - Atoms are indestructible - All atoms of an element are identical - Atoms of different elements have different masses - When elements react, their atoms combine in simple, whole number ratios Some of the details off Dalton’s original theory are now known to be incorrect. But the core concepts of the theory (that chemical reactions can be explained by the union and separation of atoms, and that these atoms have characteristic properties) are foundations of modern physical science. 4. Dalton and a few Greek philosophers proposed that matter is discrete. Beyond a certain point, a substance cannot be cut into smaller pieces that retain the properties of the whole. They called the smallest possible piece an “ atom". 5. Sir William Crookes gained more knowledge about the mysterious green glow when he created a bent Geissler tube in 1875. He noticed that the glow was the most intense opposite the negative electrode, also called the cathode. Crookes

reasoned that rays traveled from the cathode and then hit the end of the tube. Because of this, Crookes named these rays cathode rays. 6. After further experiments, Crookes proved: a) All cathode rays have identical properties- the material the cathode is made of does not matter. b) Cathode rays normally travel in straight lines perpendicular to the cathode. c) Magnetic fields change the path of the cathode rays. (Crookes suspected that any charged object, not just magnets, could change the path of cathode rays.) d) Rays caused reactions similar to those caused by light. e) Scientists could not decide if cathode rays were electromagnetic waves of negatively charged particles. 7. Thompson used an external magnetic field which established that the cathode ray contains mass. The path of the cathode ray is also affected by an external electric field. Thompson used that phenomenon to determine that a cathode ray is charged. By studying the magnitude of deflections of cathode rays in different strengths of electric and magnetic fields, Thompson determined the mass-to-charge ratio of the beam particles. 8. Thomson boldly announced the hypothesis that " we have in the cathode rays matter in a new state, a state in which the subdivision of matter is carried very much further than in the ordinary gaseous state: a state in which all matter... is of one and the same kind; this matter being the substance from which all the chemical elements are built up. " 9. Thomson discovered that atoms can be cut. He found this out while studying rays traveling between charged metal plates in a vacuum tube. He discovered that the rays were consisted of negatively charged particles. He had just discovered electrons. He discovered all of this on a trip from America. Since electrons are so small, he believed that they could only be from inside of the

atom. Since Thomson's discovery of the electron, John Dalton's theory that atoms are indivisible had to be changed. 10. The droplets just fall down together uniformly 11. The droplets change directions moving upwards instead. 12. At about 8 x 10^3 V, is when some of the droplets are suspended in midair. 13. Millikan concluded that -1. 60 x 10^-19 coulombs was the fundamental unit of charge, the charge of an electron. 14 . Thompson was not clear on how the protons and electrons were arranged and therefore only suggested the “ plum pudding, " where the protons and electrons are uniformly mixed throughout the atom. 15. When the slit of the lead screen was adjusted to 4. 0 nanometers, the amount of alpha particles that passed the gold foil increased of course, but now there are actually alpha particles that are being deflected off instead of every single atom passing through. 16. Rutherford tested Thompson’s hypothesis by devising his “ gold foil" experiment. Rutherford reasoned that if Thomson’s model was correct then the mass of the atom was spread out throughout the atom. Then, if he shot high velocity alpha particles at an atom then there would be very little to deflect the alpha particles. He decided to test this with a thin film of gold atoms. As expected, most alpha particles went right through the gold foil but to his amazement a few alpha particles rebounded almost directly backwards. These deflections were not consistent with Thomson’s model. 17. Rutherford was forced to discard the Plum Pudding model and reasoned that the only way the alpha particles could be deflected backwards was if most of the mass in an atom was concentrated in a nucleus. He thus developed the planetary model of the atom which put all the protons in the nucleus and the electrons orbited around the nucleus like planets around the

sun. 18. The discovery of the neutron was made by James Chadwick, who spent more than a decade searching. Rutherford gave the best description of a neutron as a highly penetrating neutral particle with a mass similar to the proton. 19. Wilhelm RÃ¶ntgen was credited for the discovery of X-rays 20. ... And so, upon learning how Wilhelm RÃ¶ntgen discovered x-rays by observing the fluorescence they produced, Becquerel had a ready source of fluorescent materials with which to pursue his own investigations of these mysterious rays. The material Becquerel chose was a double sulfate of uranium and potassium which he exposed to sunlight and placed on photographic plates wrapped in black paper. When developed, the plates revealed an image of the uranium crystals. Becquerel concluded " that the phosphorescent substance in question emits radiation which penetrates paper opaque to light.", i. e. he believed that the sun's energy was being absorbed by the uranium which then emitted x-rays. (http://www. physics. isu. edu/radinf/cuire. htm) 21. Polonium and Radium 22. Further investigation, on the 26th and 27 of February, was delayed because the skies over Paris were overcast and the uranium-covered plates Becquerel intended to expose to the sun were returned to a drawer. On the first of March, he developed the photographic plates expecting only faint images to appear. To his surprise, the images were clear and strong. This meant that the uranium emitted radiation without an external source of energy such as the sun. Becquerel had discovered radioactivity, the spontaneous emission of radiation by a material. Later, Becquerel demonstrated that the radiation emitted by uranium shared certain characteristics with x-rays but, unlike the latter, could be deflected by a magnetic field and therefore must consist of charged

particles. For his discovery of radioactivity, Becquerel was awarded the 1903 Nobel Prize for physics. (http://www. physics. isu. edu/radinf/cuire. htm)