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Glue a vial onto the bottom of a flask. Pipet into the vial some Fe NO_3 3 aq. Pipet around this some NaOH aq. Weigh the setup using the most accurate balance available. Tip the flask and allow the solutions to react.

Animation "Reactions with Oxygen 3. The Law of Multiple Proportions is probably the hardest concept in this chapter for students to grasp. Emphasize that it is mass ratios, and the ratios of these ratios, that matter. Give students some mass percentages and have them convert these into mass ratios. Animation "Multiple Proportions 7. Mention here that we will use simple electrostatics charge attractions and repulsions to explain and understand many chemical properties. If available, show a CRT as in Figure Try reversing the leads and see the effect. Also demonstrate the effect of a magnetic field. Note that the electrons are not attracted or repelled but rather are deflected by a magnetic field. The effect of a magnetic field on a charge is somewhat of a surprise to many students, and is not intuitive. Emphasize that the effect only works when a charge is moving, and results in a deflection, not an attraction or repulsion. The magnetic deflection effect can be used to identify the poles of a magnet. Animation "Millikan Oil-Drop Experiment Animation "Alpha, Beta and Gamma Rays Discuss, possibly at the end of the next section, that beta particles result from the decay of a neutron into a proton and a high kinetic energy electron. Animation "Rutherford Experiment He proposed the nuclear atomic structure without observation of any direct form of imagery. Atomic level scattering experiments became important again in the latter half of the 20th century. The masses of the proton and neutron are slightly different has been clearly demonstrated. The charges of the proton and electron, however, are believed to be exactly equal in magnitude but opposite in sign. The electron is believed to be truly fundamental. Modern particle physics now considers the neutron and proton to be composed of other, more fundamental particles. Some elements only have one naturally-occurring isotope. Common examples are beryllium-6, fluorine, sodium and aluminum Activity "Isotopes of Hydrogen Usually all the isotopes of an element share the same name and atomic symbol. The exception is hydrogen. Isotope 2H is called deuterium symbol D and 3H is tritium T. D_2O melts at 3. Hydrogen is unusual in that the different isotopes and their compounds have significantly different properties. Traces of naturally occurring radioactive isotopes appear in our ecosystem in carbon, hydrogen and potassium. Simulation "Mass Spectrometer The mass spectrometer depicted in Figure uses electrostatic deflection to separate a beam of ions. Other designs use a magnetic deflection effect. The primary standard for atomic masses has evolved over time. Later, chemists took naturally occurring oxygen as 16 u to be the definition of their atomic weight scale. Concurrently, physicists defined just the oxygen-16 isotope as 16 u. This resulted in conflicting values. In the adoption of carbon as a universal standard resolved this disparity. Students frequently confuse the terms atomic number, mass number, isotopic mass and atomic mass. The other atomic masses on row 2, and many others, are nearly integral. This suggests that these elements have a single predominant isotope. The abundances of these just happen to average close to an integer! Activity "Interactive Periodic Table This can be performed solely in miniature. Use an evaporating dish with watch-glass cover on an overhead projector. Cut a small corner off of a larger piece of sodium and blot to remove any oil. Use tweezers to drop the sodium onto the water and cover quickly. Note that the sodium melts due to the heat of reaction. Complete and balance a net ionic equation for the reaction. Repeat the experiment after adding phenolphthalein indicator to a fresh portion of water. The point here is that all Group I metals do this, with varying rates of reaction. This forms explosive peroxides and is not recommended. That elements in one group have similar properties is perhaps the most useful simplifying feature of atomic properties. Significant differences in one group do occur. The manner and reason for such differences is much of what we try to discover in studying chemistry. The arrangement of the elements in the

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modern periodic table is based on atomic numbers. Perhaps the most constant property of the elements in one group is their combining capacity, as indicated by the formula of their compounds. Two compounds more dissimilar than CO_2 and SiO_2 , in terms of their physical and chemical properties, probably cannot be found. They do have the same formula. The topic of stoichiometry is spread over 3 chapters. Chapter 2 introduces the mole for elements. Chapter 3 continues with compounds. Chapter 4 applies mole concepts to reactions. It also permits blending a largely mathematical procedure with chemical applications and some more qualitative topics. A mole of carbon is defined to be 12 g. The mass of one carbon atom is measured using a mass spectrometer and found to be 1. In the mid 20th century the value first fluctuated and then stabilized, as mass spectra methods were revised and improved. Some students require some time to understand this. Using quantities like a dozen and a gross to help explain these topics is helpful. While molar masses vary considerably, say from carbon to lead, the volume stays reasonably constant. We shall discuss important atomic radius differences later, but many atoms have roughly the same size.

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