EXAM 1 study guide

Atoms First 2e sections: 1.1-1.6, 2.1-2.6, 3.1-3.10

**DAY 1, Terms to know**:

Sections 1.1-1.3 matter, scientific method, law, hypothesis, theory, substance, homogeneous mixture, heterogeneous mixture, quantitative, qualitative, physical property, physical change, chemical property, chemical change, extensive, intensive

**DAY 1, Specific outcomes and skills that may be tested on exam 1:**

Sections 1.1-1.3

* Be able to describe and give examples that differentiate between matter and nonmatter
* Be able to explain how to use the scientific method generally and within the context of a specific example of a scientific question or problem to solve
* Be able to identify items as substance, homogeneous mixture, or heterogeneous solution, and be able to give some specific examples and explain HOW they fit into each category
* Be able to identify properties or changes as chemical or physical and be able to give examples of each and explain HOW the fit into each category
* Be able to identify properties as intensive or extensive and be able to give examples of each and explain HOW the fit into each category

**DAY 2, Terms to know**:

Sections 1.4-1.5 mass, atomic mass unit, temperature, volume, density, significant figures, meaningful digit, uncertain digit, accuracy, precision

**DAY 2, Specific outcomes and skills that may be tested on exam 1:**

Sections 1.4-1.5

* Be able to convert temperature measurements from °C to K and vice versa
* Be able to explain how to get the correct number of sig figs from a measuring device
* Given a number that was measured, be able to determine how many sig figs the number has
* When adding or subtracting measured values, be able to determine the answer with correct sig figs
* When multiplying or dividing measured values, be able to determine the answer with correct sig figs
* Be able to recognize when numbers are exact and have infinite sig figs
* Given measurement(s) and a known value, be able to reasonably describe the accuracy of the measurement(s)
* Given multiple measurements, be able to reasonably describe the precision of the measurements

**DAY 3, Terms to know**:

Sections 1.6, 2.1-2.2 conversion factor, dimensional analysis or factor label, atom, element, radiation, cathode ray tube, cathode, anode, electron, alpha rays, beta rays, gamma rays, x-rays, protons, neutrons

**DAY 3, Specific outcomes and skills that may be tested on exam 1:**

Sections 1.6, 2.1-2.2

* Depending on given data, be able to calculate density or use density to calculate mass or volume
* Be able to use dimensional analysis (factor label method) to do unit conversions using any of the units discussed or any relationships given in the problem
* Be able to describe what a cathode ray tube is and how that gives information about atomic structure
* Be able to describe how measurements of alpha, beta, and gamma rays gave information about atomic structure
* Be able to describe how the Rutherford gold experiment gave information about atomic structure

**DAY 4, Terms to know**:

Sections 2.3-2.6, 3.1 atomic number, mass number, isotope, average mass, isotopic natural abundance, periodic table, halogens, noble gasses, transition metals, energy, kinetic energy, thermal energy, potential energy, chemical energy, electrostatic energy, law of conservation of energy, joule

**DAY 4, Specific outcomes and skills that may be tested on exam 1:**

Sections 2.3-2.6, 3.1

* Be able to use elemental symbols to determine how many protons, neutrons, and electrons are present in an atom
* Given a specific number of protons, neutrons, and electrons, be able to give a complete elemental symbol including element, mass, and charge
* Given isotopes and their natural abundance, be able to calculate the average atomic mass
* Given an average atomic mass and two or three isotopes, be able to describe the isotopes relative abundances
* Be able to describe possible transformations from one form of energy to another
* Given a process that involve a transfer of energy, be able to describe to describe what forms of energy exist before and after the process

**DAY 5, Terms to know**:

Sections 3.2-3.6 light, radiant energy, electromagnetic spectrum, wavelength, frequency, amplitude, hertz, constructive and destructive interference, quantum, photoelectric effect, photon, line spectra or emission spectra, ground state, excited state, node, wave function, electron density

**DAY 5, Specific outcomes and skills that may be tested on exam 1:**

Sections 3.2-3.6

* Be able to describe the properties of light existing as both a wave and a particle
* Given that the speed of light is constant, be able to describe and fully explain the either directly or inversely proportional relationships between energy, frequency, and wavelength
* Be able to describe the photoelectric effect in detail including how the photoelectric effect resulted in information about the nature of electrons and atoms
* Be able to explain how the existence of line spectra suggest that electron as in quantized energy levels
* Be able to explain two reasons why different elements give different line spectra
* Be able to describe the potential energy difference between various excited states and between excited states and the ground state for an atom and explain why
* Be able to explain what a node is and how the existence of nodes suggests that electrons behave as waves in addition to behaving as particles in other experiments
* Be able to describe what electron density and orbitals are and how they relate to electron probability

**DAY 6, Terms to know**:

Sections 3.7-3.8 quantum numbers, orbitals, Pauli exclusion principle

**DAY 6, Specific outcomes and skills that may be tested on exam 1:**

Sections 3.7-3.8

* Given a set of quantum numbers, be able to describe the energy level, subshell (s, p, d, or f), and spin state for an electron
* Given information about the principle energy level or shell, subshell (s, p, d, or f), and orbital, be able to determine a set of 4 possible quantum numbers for an electron
* Be able to recognize that no two electrons in the same atom can have the same values for each of the 4 quantum numbers
* Be able to describe an experiment that could be used to show that half of the electrons in an atom have a spin = ½ and the other half have a spin = -½.
* Be able to draw a figure that shows the shape and location of nodes in any orbital in the 1st, 2nd, or 3rd energy level of an atom
* Be able to rank the relative energies of any two orbitals in the 1st, 2nd, or 3rd energy levels of an atom and explain WHY

**DAY 7, Terms to know**:

Sections 3.9-3.10 electron configuration, Aufbau principle, Hund’s rule, orbital diagram

**DAY 7, Specific outcomes and skills that may be tested on exam 1:**

Sections 3.9-3.10

* Be able to use the Pauli exclusion principle and Aufbau principle to give a complete or abbreviated electron configuration for an atom in either its ground state or one possible excited state
* Given an electron configuration, be able to give a complete elemental symbol for an atom
* Be able to use the Pauli exclusion principle, Aufbau principle, and Hund’s rule to give a complete or abbreviated orbital diagram for an atom either its ground state or one possible excited state
* Given an orbital diagram, be able to give a complete elemental symbol for an atom or ion
* Be able to recognize and explain how Cr and Cu are exceptions to the Aufbau principle

**DAY 8: Exam 1**