Atomic structure worksheet atom properties and isotopes

Title: Section: - Student ID: . . . . You should try to answer questions without referring to your tutorial. If you are stuck, try asking another group for help. Atomic theory of matter is a great organizing principle of chemistry. Atoms are the fundamental building blocks of the whole substance. Mass relationships between elements and compounds in chemical reactions are ultimately associated with the characteristics of the atoms of which they are composed. To understand how atoms combine into compounds, it is necessary to understand their basic composition and structure. Exploring an objective understanding of the basis of atomic theory Understanding the structure of atoms, isotopes, Ions Understand the relationship between the masses of isotopes and the atomic weight of the element Read the periodic table Of Success Criteria Be able to write a standard nuclide notification for the isotope Be able to determine the number of fundamental particles in atoms and ions Be able to calculate the atomic mass of the isotope mixture and the percentage of isotope composition be able to classify the elements by position in the periodic table Dalton atomic theory was partly based on the work of the French scientist Joseph Louis. who discovered what is now called the Law of Certain Proportions (also called the law of permanent composition) : The connection always consists of the same elements in a fixed weight ratio. Example: At a full reaction of 200.59 grams of mercury column with a content of 32,066 grams of sulfur produced 232.66 grams of hydrogen sulfide red mercury. What is the percentage of red mercury hydrogen sulfide? %Hg dfrac200.59,g'232.66,g,gtimes 100% 86.216 %Hg %S dfrac 32.2 Found 100,782 g/g for each sample of red mercury sulfide of the same percentage composition by weight (mineral cinnamon is a compound). It follows that the combination of mercury and sulfur with any other percentage of weight should be another substance. The discovery of Proust suggested to Dalton that the elements from which the compounds are formed should consist of indivisable units that are combined in a certain way. From this idea he proposed an atomic theory, which in modern terminology consists of the following points: all matter consists of atoms. All atoms of the element have the same mass (atomic weight). All atoms elements have different masses (i.e. different atomic weights). Atoms are indestructible and indivisible. Connections are formed when atoms of two or more elements are combined. In the complex, relative numbers and types of atoms are constant. Points 2, 3 and 4 are now known to be incorrect, in light of the following later discovered facts: Many elements consist of a mixture of mixture atoms of the same element with different masses. Some atoms of two different elements may have almost the same mass; they are called isobare. Atoms can be separated (split) or merged (merging) in nuclear reactions. Part of the mass of atoms is converted into energy in nuclear reactions. What is the law of certain proportions in your words? Why does the Law of Certain Proportions propose the tenets of Dalton's atomic theory? Dalton knew that some pairs of items could make more than one type of connection and that the percentages of each item were different in each case. Based on his atomic theory, he predicted and experimentally tested the Law of Multiple Proportions: if two elements can form more than one compound, the ratios of weight of one element in the compounds to the fixed weight of the other element are small whole numbers. Explain how Dalton's atomic theory predicts the Law of Multiple Proportions. Suppose elements X and Y can form two connections. One compound has as many X atoms as Y atoms (XY), and the other compound has twice as many atoms (X) atoms (formula (X_2Y).) What mass ratios would you compare between these connections to demonstrate the Law of Multiple Proportions? What ratio of numbers would one expect between these ratios? The chemist has prepared three different compounds that contain only iodine and fluoride and determine the mass of each element in each compound, as shown below. Calculate the mass of fluoride per gram of iodine in each compound and explain how your results support the atomic theory. Connection (m_I) (g) (m_F)) (h) (h) (drafra) m_I 1 m_F 4.75 3.56 2 7.64 3.43 3 9.41 9.4186 Today we know that atoms can consist of three fundamental particles: Particle Charge (unit) Mass Proton 1 (1,1,300 6726 times 10-24, kg) Neutron 0 (1.6749 times 10-24 , Kg) Electron No1 (9.1095 (once 10'-28), Electric charge block is (1.6022 (once 10'-19)) kulb (C). All atoms of this element have the same the number of protons that determines the atomic number of the element, given the symbol. In addition, the nucleus may contain one or more neutrons that have about the same mass as protons but do not have a charge. Together, protons and neutrons are known as nuclei. Any atom with a certain amount of nucleons is called nuclide. The number of nucleons determines the mass number of nucleides, given the symbol (A): Text number of protons (text number of neutrons) Note that the mass number is a more integrative number of nucleons, rather than the assertion of the mass of the atom. nuclides of different elements of the elements With the same massive number (I)). Isobare have almost the same mass. The standard notation for nuclid is shaped like ceAX, where the symbol of the element is (X); ( ) is its atomic number equal to the number of protons; and (A) is a mass number equal to the total number of nucleons (protons and neutrons). The electrically neutral atom has the same number of protons as electrons, negatively charged particles that are outside the nucleus. Atoms can acquire an electrical charge by acquiring or losing one or more electrons, thus becoming monotomic ion. Positive ions are cations; negative ions are anions. Atom right (Cation) ion- (Atom) - right (Anion) What is the basis for determining the atomic number (yap) of the element? What is the basis for determining the mass number of nuclid? Accurate or non-operational figures? How does an atom become a cation or anion? Is the change in the formation of the ion changing? Why or why not? In some nuclear reactions, the number of protons of an atom may change. Is this the same element after such a change? On the periodic table attached, each block shows the atomic number of the element at the top, above the element symbol. Using a periodic table, give a standard nuclide notation for the following isotopes used in medicine: phosphorus-32, chrom-51, cobalt-60, iodine-131. Using the periodic table, fill in the gaps in the following table: Charge 0 0 0 -3 -2 Symbol ((Se {56}Fe) Protons (Yap) 35 34 Neutrons 45 38 Electrons 79 28 Mass Number (I)) 197 79 Because the masses of atoms are so small that the masses of atoms are so small, it is more convenient to give nucleid masses in units of atomic mass, abbreviated amu or y (the latter is the official acronym SI), rather than grams. The atomic mass unit is defined as one unit of atomic mass as 1/12 of the mass of the {12} {6}C atom). In units of atomic mass fundamental particles have the following proton masses: 1.007277 u neutron: 1.008665 u electron: 0.0005486 u We cannot use this data to calculate the mass of this atom, because the mass of nucleid is not just the sum of the masses of its fundamental particles. When atoms are formed from protons, neutrons and electrons, some mass is converted into an energy called energy binding. The mass equivalent of this energy can be calculated on the basis of the difference between the measured mass of nucleid and the mass of its subatomic particles, using Einstein's famous formula: E mc 2 where (m) is the mass converted into energy, and (c) is the speed of light in a vacuum. Because of the existence of isotopes, the mass of individual atoms in the sample of the element may not be the same. Indeed, with some exceptions, the most natural sample elements are mixtures of two or more isotopes in unequal Usually we deal with samples containing a large number of atoms, with the usual mixture of isotopes for the element, so it is more useful to use the average atomic mass, weighted depending on isotopic abundance. According to a long tradition, this average was called atomic weight, although the quantity is actually mass. As a rule, tabulated atomic weights for elements do not represent the mass of one nuclid, unless the element arises naturally as just one isotope. For all elements except fluoride, the atomic weight listed on the periodic table does not correspond to the mass of any nuclide? What is the atomic mass of most elements? The atomic weight listed for fluoride on the periodic table (18.998403 u) really corresponds to the mass of a particular nuclid. What does this mean in the isotopic composition of natural fluoride? The boron sample found on Earth consists of 19.78% ({10}B) with an atomic mass of 10.0129 you and 80.22% (CE {11}B) with an atomic mass of 11,00931 u. Calculate the atomic weight of the natural boron. By definition, the mass of the atom Z ({12}{6}C) is exactly 12 u. What is the sum of the mass of particles (nucleons and electrons) consisting of a neutral atom {12}{6}C)? Why the sum is not 12 u? Information In 1869, Dmitry Mendeleev (Russian) and Julius Lothar Meyer (German) independently discovered that when the elements are arranged in the order of their atomic scales, the characteristic properties of some elements are repeated in other heavy elements at regular intervals in sequence. The first statement of periodic law came out of this: the properties of the elements are the periodic function of their atomic scales. This order, however, seems to place some elements out of the sequence. The best location, based on the atomic room, was made possible in 1913, when Henry G. J. Moseley discovered that the atomic number of elements could be determined experimentally from their characteristic X-ray frequencies. Today, periodic law is based on atomic numbers, and not on atomic scales: The properties of the elements are a periodic function of their atomic numbers (. . . . The element symbol below it and the atomic weight of the natural sample of the element below its symbol. by listing items that tend to show similar chemical behavior. In North America, groups of promachers from 1 to 8 (or 0) with the appendage of the letter A or B (e.g. 1A, 3B). The new I.U.P.A.C. system uses numbers 1 to 18. Although hydrogen, H, is sometimes shown in group 1 (and even in group 17), it does not belong to any group because his chemistry is unique. Unique. - a line in the periodic table. Periods run from 1 to 7. The main elements of the group (or representative elements) are members of Group A (the old North American system); i.e. Groups 1A (1) and 2A (2), and 3A (13) via 8A (18) (new I.U.P.A.C. system designations). Transition elements - members of Group B (old North American system) corresponding to groups 3 to 12 in the I.U.P.A.C. system First, second and third transition series cover these groups in periods 4, 5 and 6 respectively. Element 89 (Actinium, Ac) begins the fourth series of transitions in period 7, which will continue with elements 104 to 112, but these are all unstable synthetic elements. Lantanids - elements 58 to 71 in the front row at the bottom of the periodic table (continued period 6). Lantanum (La) is actually the first element of the third series of transitions, not the lantanid. acticides - elements 90 to 103 in the second row at the bottom of the periodic table (continued period 7). Actinium (Ac) is actually the first element of the incomplete fourth series of the transition, not the acticide. There are three categories of elements: metals, non-metals and metaloids, defined as follows: metals - elements in groups 1A (1) and 2A (2A), transitional elements, lantanids and actilids, and heavier elements in groups 3A (13) through 5A (15), which lie below the ladder step shown on some periodic tables. At room temperature, metals are shiny solids (except mercury and gallium above 29.78o C, which are liquids) that are malleable, duct-ing and conductive heat and electricity. Metals characteristically are cations in their ion compounds. nonmetals - elements in groups 4A (14) through 7A (17), which lie above the step stairs on some periodic tables. Individual non-metals can be either solids, liquids, or gases at room temperature. They are poor conductors of heat and electricity. Nonmetals are characteristic of anions when existing as monotomic ions in ion compounds. In combination with other non-metal, they usually form molecular compounds or complex ions. metaloids - elements B, Si, Ge, As, Sb, Te, Po, At, which lie along the stairs step shown on some periodic tables. They are all solids with semi-metallic properties. They show lower conductivity in relation to metals and can be semiconductors (e.g. Si and Ge). What information about the item is provided in the field for this item in the periodic table? What determines the sequence of elements from the first to the last? What is the difference between a group and a period? Where are metals, non-metals and metaloids? Are most elements of metals, non-metals or metaloids? Does hydrogen belong to Group 1? Why or why not? Exercise Write a name, symbol, atomic number and average mass each of the following, the following, indicate whether the element is metal, non-metal or metaloid: Group 2 element in period 3 Group 16 Element in Period 2 Group 15 Element in Period 4 Write the name and symbol of an element that has 48 electrons. Name items with properties similar to chlorine, Cl. Give symbols and names of elements 57 and 72 in period 6. Why do they join each other in the periodic table? The chlorine problem consists of q ({35}Cl) with a mass of 34.96885 you and q (se {37}Cl) with a mass of 36.96590 u. Atomic weight of chlorine is 35,453 u. What percentage of abundance of each isotope? Isotope? atomic structure worksheet atom properties and isotopes answer key