Atoms structure worksheet pdf

Name:

If you get stuck, try asking another group for help. Atomic theory of matter is the great organizational principle of chemistry. Atoms are the main building blocks of any matter. The mass relationships between elements and compounds in chemical reactions ultimately refer to the characteristics of the atoms from which they are composed. To understand how atoms combine to form compounds, you need to understand their basic composition and structure. Purpose of study Find out the basis for atomic theory Understanding the structure of atoms, isotopes, and ions Understanding the relationship between the masses of isotopes and the atomic weight of an element Meet the periodic table Success criteria To be able to write the standard nuclide notation for isotope Yes can determine the number of main particles in atoms and ions To be able to calculate the atomic mass of a mixture of isotope Atomic Theory of Dalton Scientist Joseph Louis Proust in 1799, who discovered the now-called Constant Proportions Act (also called the Constant Composition Act: The compound always consists of the same elements in a fixed ratio by weight. Example: When 200.59 g of mercury reacts completely with 32,066 g of sulfur, 232.66 g of red mercury sulphide is obtained? \[\%Hg = \dfrac{200.59\ , g}{232.66 \, g} \times 100\% = 86.216 \%Hg\] \[\%S = \dfrac{ 32.%S =32.%066\, g}{232.66 \, g} \times 100\% = 13.782 \%Hg\] For each sample of red mercury sulphide, the same percentage of composition by weight is found (the mineral cynabit is this compound). It follows that the compound of mercury and sulphur with another percentage by weight must be a different substance. Proust's discovery suggests that the elements from which the compounds are formed must consist of indivisible units which are combined in a certain way. From this idea he proposes atomic theory, which in modern terminology consists of the following points: All matter consists of atoms. All atoms of one element have the same mass (atomic weight). All atoms of different elements have different masses (i.e. different atomic weights). Atoms are indestructible and indivisible. Compounds are formed when atoms of two or more elements are combined. In a compound, relative numbers and types of atoms are constant. Points 2, 3 and 4 are currently known to be false, given the following later findings: Many elements are composed of a mixture of the same element with different tables. Some atoms of two different elements may have almost the same mass; they are called isobars. Atoms can be separated (fission) or merged (synthesis) into nuclear reactions. Part of the mass of atoms turns into energy in nuclear reactions. What is the Law of certain proportions in your words? Why does the Law of Defined Proportions imply the postulate of Dalton's atomic theory? Dalton knew that some pairs of elements could make more than one type of compound and that the percentages of each element were different on a case-by-case basis. Based on his atomic theory, he predicted and experimentally checked the Multiple Proportions Act: If two elements can form more than one compound, then the weight ratios of one element in the compounds to the fixed weight of the other element are small integers. Explain how Dalton's atomic theory provides for the Multiple Proportions Act. Assume that elements X and Y can form two compounds. One compound has as many X atoms as Y atoms (formula \(XY\)), and the other compound has twice as many \(X\) atoms as \(Y\) atoms (formula \(X_2Y\)). What mass ratios would you compare between these compounds to prove the law of multiple proportions? What integer is expected between these ratios? A chemist has prepared three different compounds that contain only iodine and fluorine and determines the mass of each element in each compound as shown below. Calculate the mass of fluorine per gram of iodine in each compound and explain how your results support atomic theory. Compound \(m_I))) (g) \(m_F)\) (g) \((dfrac{m_I}{m_F}\) 1 4,75 3,56 2 7,64 3,43 3 9,41 9.8 Today we know, that atoms can consist of three main particles: Particle charging (unit) Mass Proton 1+ \(1.6726 \times 10^ -24} \, kg\) Neutron 0 \(1.6749 \times 10^ - {24} \, Kg\) Electron +1 \(9.1095\times 10^ {- 28} \, Kg \) Unit of electrical charge is \(1.6022 \times 10^ {- 19}\) cult (C). Protons. All atoms of an element have the same number of proton, which determines the atomic number of the element, given the symbol \(Z\). In addition, the nucleus may contain one or more neutrons that have approximately the same mass as protons but do not have a charge. Together, protons and neutrons are known as nucleons. Each atom with a certain number of nucleons is called nuclide. The number of nucleons determines the mass of the nuclide, given the symbol \(A\): \[A = \text{ number of protons} + \text{ number of neutrons }\] Note that the mass number is an integer of the number of nuclei, not a statement of the mass of the atom. The isotopes of one element have the same atomic number (Z), but have different mass numbers (A) because they have a different number of neutrons. Isobars are nuclides of elements elements \(Z\)) with the same mass number (\(A\)). Isobars have almost the same mass. The standard nuclide notation has the following form \[\ce{{{{A}_{Z}}}}\] where \(X\) is the symbol of the item; \(Z\) is its atomic number equal to the number of protons; and \(A\) is the mass equal to the total number of nucleons (protoons and neutrons). An electrically neutral atom has the same number of protos as electrons, negatively charged particles that are located outside the nucleus. Atoms can acquire an electrical charge by dialing or losing one or more electrons, thereby turning into ions of monatomies. Positive ions are cations; negative ions are anions. \[Atom\rightarrow [cat.] ^{n+} + ne^–\] \[Atom + ne^- \rightarrow[Anion] ^n–}\] What is the basis for determining the atomic number (\(Z\)) of an item? What is the basis for determining the mass number (\(A\)) of nuclide? Z and A are accurate or non-texts? How does an atom turn into cation or anion? Z or A changes in the formation of ionic? Why or why not? In some nuclear reactions, the number of protons of the atom may change. Is it the same element after such a change? In the attached periodic table, each block displays the atomic number of the item at the top, above the symbol of the item. Using the periodic table, give the standard notation for nuclides for the following isotopes used in medicine: phosphorus-32, chromium-51, cobalt-60, iodine-131. Using the periodic table, fill in the blank fields in the following table: Load 0 0 0 +3 character \(\ ce {ce{{56}Fe}\) Protoni (\(Z\)) 35 34 Neutrons 45 38 Electron 79 28 Mass number (\(A\)) 197 79 Because the masses of atoms are so small, it is more convenient to give nuclide masses in atomic units mass, abbreviation amu or u (the latter is an official SI abbreviation), but grams. The atomic mass unit is defined as follows: one atomic mass unit is defined as 1/12 by mass of the atom \(\c{c^{12}_{6}C}\). Proton masses: 1.007277 u neutron: 1.008665 u electron: 0.0005486 u We cannot use this data to calculate the mass of an atom because the mass of the nuclide is not just the sum of the masses of its main particles. When atoms are formed by protoons, neutrons and electrons, part of the mass becomes an energy called binding energy. The mass equivalent of this energy can be calculated from the difference between the measured mass of the nuclide and the sum of the masses of subatomic particles using Einstein's famous formula: \[E = µd^ 2\], where \(m\) is the mass converted into energy, and \(c\) is the speed of light in a vacuum. Due to the presence of isotopes, the masses of individual atoms in a sample of an element may not be the same. In fact, with a few exceptions, the most naturally occurring samples of an element are mixtures of two or more isotopes in the We usually deal with samples containing a large number of atoms with the usual combination of isotopes for the element, so it is more useful to use an average atomic mass weighted according to isotopic abundance. By long-standing tradition, this average has been called atomic weight, although the amount is actually mass. In general, the table weight towed for the elements does not represent the mass of a nuclide unless the element manifests itself naturally as only one isotope. For all elements, with the exception of fluorine, the atomic weight indicated in the periodic table does not correspond to the mass of any nuclide? What is the atomic mass of most elements? The atomic weight indicated for fluorine in the periodic table (18.998403 u) corresponds to the mass of a nuclide. What does this mean for the isotopic composition of naturally occurring fluorine? A boron sample found on the ground consists of 19.78% \(c{^ {10}B}\) with atomic mass 10.0129 and 80.22% \(c{c{^ {11}B}\) with atomic mass 11.00931 u. By definition, the mass of the atom \(c{ce{ {12}_{6}C}\) is exactly 12 u. , constituting a neutral atom \((c^{12}_{6}C}\) ? Why isn't the amount 12 u? Information In 1869, Dmitry Mendeleev (Russian) and Julius Lothar Meyer (German) independently discovered that when the elements were arranged in the order of their atomic weights, the characteristic properties of some elements were repeated in other heavier elements at regular intervals in the sequence. From this came the first statement of periodic law: The properties of the elements are a periodic function of their atomic weights. However, this arrangement seems to put some elements out of order. A better arrangement based on an atomic number was made possible in 1913, when Henry J . Moseley discovered that the atomic numbers of the elements could be determined experimentally by their characteristic X-ray frequencies. Today, the periodic law is based on atomic numbers rather than atomic weights: The properties of the elements are a periodic function of their atomic numbers (Z). In most modern periodic tables, each block for an element displays its atomic number on the first row, the symbol of the element below it and the atomic weight of a naturally present sample of the element under its symbol. The following definitions are used together with the periodic table: group - column in the periodic table, listing elements that tend to indicate similar chemical behavior. In North America, groups were numbered 1 to 8 (or 0) with letters A or B applied (e.g. 1A, 3B). The new system uses numbers 1 through 18. Although hydrogen, H, is sometimes shown in group 1 (and even group 17), it really does not belong to the group, because its chemistry is unique. - line in the periodic table. The periods are from 1 to 7. main elements of the group (or representative elements) - members of the group elements of Group A (old North American system); i.e. groups 1A(1) and 2A (2) and 3A (13) to 8A (18) (newer I.U.P.C. systems in brackets). transition elements - members of the B group of elements (the old North American system) corresponding to groups 3 to 12 in the I.U.P.A.C. System. The first, second and third transition series shall cover these groups in periods 4, 5 and 6 respectively. [Element number 89 (actin, AC) in period 7 begins a fourth transitional series, which will continue with elements 104 to 112, but they are unstable, synthetic elements.] lanthanides - elements from 58 to 71 of the first row at the bottom of the periodic table (over a period of 6). Lantanium (La) is actually the first element of the third transitional series, not lanthanide. actinides - elements from 90 to 103 of the second row at the bottom of the periodic table (over a period of 7). Actin (AC) is actually the first element of the incomplete fourth transition series, not actinide. There are three categories of elements: metals, non-metals and metaloids defined as follows: metals - elements in groups 1A (1) and 2A (2), transitional elements, lanthanides and actinides, and heavier elements in groups 3A (13) to 5A (15) lying under the staircase shown in some periodic tables. At room temperature, metals are shiny solids (except mercury and gallium above 29.78 ° C, which are liquids), which are a cognac, a pimp, and conductivity of heat and electricity. Metals are cations in their ion compounds. non-metalls - the elements in groups 4A (14) to 7A (17), which lie above the staircase of some periodic tables. Individual non-metalls can be solids, liquids or gases at room temperature. They are bad conductors of heat and electricity. Non-metals are characteristic anions that exist as monatomines in ionic compounds. When combined with other non-metals, they usually form molecular compounds or complex ions. metaloids - the elements B, Si, Ge, As, Sb, Te, Po, B, which lie on the stairs shown on some periodic tables. All are solid with semi-metallic properties. They show less conductivity in terms of metals and can be semiconductors (e.g. Si and Ge). What information about an item is provided in the field for that item in the periodic table? What determines the sequence of items from first to last? What is the difference between group and period? Where are the metals, non-metals and metal lydes? Most of the elements metals, non-metals or metaloids? Is it group 1 hydrogen? Why or why not? Exercises Write the name, symbol, atomic number and average mass for each of the following, Indicate whether the element is metal, non-metallic or metaloid: The element of group 2 in the period 3 The element group 16 in point 2 The element group 15 in the period 4 Write the name and symbol of the element, which has 48 electrons. Name items with chlorine-like properties, Cl. Give the symbols and names of items 57 and 72 in period 6. Why are they adjacent to each other in the periodic table? The problem is \(c{c{^ {35}Cl}\) with a mass of 34.96885 you and \(c{ce^ {37}Cl}\) with a mass of 36.96590 u. Atomic chlorine weight is 35.453 u. What is the percentage of abundance of each isotope?