AQA Chemistry GCSE – Student Progress Sheet

Unit 4.1 - Atomic Structure and the Periodic Table

4.1.1. A Simple Model of the Atom, Symbols, RAM, Electronic Charge and Isotopes

4.1.1.1. Atoms, Elements and Compounds

a	I know that all substances are made of atoms and that an atom is the smallest part of an element that can exist.			
b	I know that atoms of each element are represented by a chemical symbol, e.g. O represents an atom of oxygen, Na represents an atom of sodium.			
c	I know that there are about 100 different elements and that these are shown in the periodic table, and I can use the names and symbols of the first 20 elements and those in Groups 1 (alkali metals) and 7 (halogens).			
d	I know that compounds are formed from elements during chemical reactions and I can name compounds from given formulae or symbol equations.			
e	I can describe how one or more new substances (products) are formed during chemical reactions and that this often involves a detectable energy change.			
f	I know that compounds contain two or more elements chemically combined in fixed proportions and that they can be represented by formulae (using the symbols of the atoms from which they were formed, e.g. H2O).			
g	I know that compounds can only be separated into elements by chemical reactions.			
h	I can represent chemical reactions by word equations and balanced symbol equations (using formulae).			
i	I can write balanced half equations and ionic equations where appropriate. (HT only).			

4.1.1.2. Mixtures

a	I know that a mixture consists of two or more elements or compounds not chemically combined together and that the chemical properties of each substance in the mixture are unchanged.			
b	I can describe how mixtures can be separated by physical processes such as filtration, crystallisation, simple distillation, fractional distillation and chromatography.			

4.1.1.3. The Development of the Model of the Atom

a	I can explain how new experimental evidence may lead to a scientific model being changed or replaced e.g. the nuclear model of the atom replaced the plum pudding model, based on the results of the alpha particle scattering experiment.			
b	I know that, before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided.			
c	I can describe the plum pudding model of the atom: the atom is a ball of positive charge with negative electrons embedded in it.			
d	I can describe the alpha particle scattering experiment and explain how the results from it led to the conclusion that the mass of an atom was concentrated at the centre (nucleus) and that the nucleus was charged.			
e	I know that Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances, and that the theoretical calculations of Bohr agreed with experimental observations.			
f	I can explain how later experiments led to the idea that the positive charge of any nucleus could be subdivided into a whole number of smaller particles (each particle having the same amount of positive charge) and that the name proton was given to these particles.			
g	I know that the experimental work of James Chadwick provided evidence to show the existence of neutrons within the nucleus.			

4.1.1.4. Relative Electrical Charge of Subatomic Particles

a	I know that the relative electrical charge of the subatomic particles in an atom are: • Proton +1 • Neutron 0 • Electron -1			
b	I know that atoms have no overall electrical charge because the number of electrons (negative charge) is equal to the number of protons (positive charge).			
c	I know that the number of protons in an atom of an element is its atomic number (see periodic table) and that all atoms of a particular element have the same number of protons.			
d	I can use the nuclear model to describe atoms.			

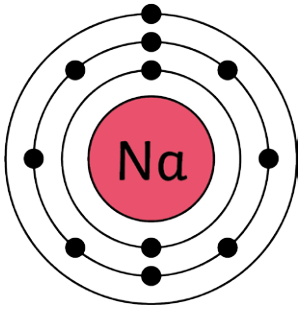
4.1.1.5. Size and Mass of Atoms

a	I know that atoms are very small, having a radius of about 0.1nm (1 x 10^{-10}m). The radius of a nucleus is less than 1/10 000 of that of the atom (about 1 x 10^{-14}m).			
b	I know that almost all of the mass of an atom is in the nucleus.			
c	I know that the relative masses of protons, neutrons and electrons are: • Proton 1 • Neutron 1 • Electron very small (almost 0).			
d	I know that the sum of the protons and neutrons in an atom is its mass number (see periodic table).			
e	I know that atoms of the same element can have different numbers of neutrons and that these atoms are called isotopes (of that element) e.g. carbon 12 and carbon 14.			
f	I can use the periodic table to calculate the number of protons, neutrons and electrons in an atom (or ion).			

4.1.1.6. Relative Atomic Mass

a	I know that the relative atomic mass of an element is an average value that takes account of the abundance of the isotopes of the element.			
b	I can calculate the relative atomic mass of an element given the percentage abundance of its isotopes.			

4.1.1.7. Electronic Structure

a	I know that the electrons in an atom occupy the lowest available energy levels (innermost available shells).			
b	I can represent the electronic structure of an atom by numbers or by a diagram, e.g. the electronic structure of sodium is 2,8,1 or: 			

4.1.2. The Periodic Table

4.1.2.1. The Periodic Table

a	I know that the elements in the periodic table are arranged in order of atomic (proton) number, so that elements with similar properties are in columns, known as groups. (it is called a periodic table because similar properties occur at regular intervals).			
b	I know that elements in the same group in the periodic table have the same number of electrons in their outer shell (outer electrons) and this gives them similar chemical properties.			
c	I can explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number.			
d	I can predict possible reactions and probable reactivity of elements from their positions in the periodic table.			

4.1.2.2. Development of the Periodic Table

a	I know that before the discovery of protons, neutrons and electrons, scientists attempted to classify the elements by arranging them in order of their atomic weights.			
b	I know that the early periodic tables were incomplete and some elements were placed in inappropriate groups if the strict order of atomic weights was followed.			
c	I can describe how Mendeleev overcame some of the problems (by leaving gaps for elements that he thought had not been discovered and in some places changed the order based on atomic weights).			
d	I can describe how elements with properties predicted by Mendeleev were later discovered that filled the gaps.			
e	I can describe how the knowledge of isotopes made it possible to explain why the order based on atomic weights was not always correct.			

4.1.2.3. Metals and Non-Metals

a	I know that elements that react to form positive ions are metals and that elements that do not form positive ions are non-metals.			
b	I know that the majority of elements are metals and that they are found to the left and towards the bottom of the periodic table.			
c	I know that non-metals are found towards the right and top of the periodic table.			
d	I can explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties.			
e	I can explain how the atomic structure of metals and non-metals relates to their position in the periodic table.			
f	I can explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number.			

4.1.2.4. Group 0

a	I know that the elements in Group 0 of the periodic table are called the noble gases and that they are unreactive and do not easily form molecules because their atoms have stable arrangements of electrons (full outer shell: eight electrons in their outer shell, except for helium, which has only two electrons).			
b	I know that the boiling points of the noble gases increase with increasing relative atomic mass (going down the group).			
c	I can explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms.			
d	I can predict properties from given trends down the group.			

4.1.2.5. Group 1

a	I know that the elements in Group 1 of the periodic table are known as the alkali metals and have characteristic properties because of the single electron in their outer shell.			
b	I can describe the reactions of the first three alkali metals with oxygen, chlorine and water.			
c	I know that in Group 1, the reactivity of the elements increases going down the group.			
d	I can explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms			
e	I can predict properties from given trends down the group.			

4.1.2.6. Group 7

a	I know that the elements in Group 7 of the periodic table are known as the halogens and have similar reactions because they all have seven electrons in their outer shell.			
b	I know that the halogens are non-metals and consist of molecules made of pairs of atoms.			
c	I can describe the nature of the compounds formed when chlorine, bromine and iodine react with metals and non-metals.			
d	I know that, in Group 7, the further down the group an element is, the higher its relative molecular mass, melting point and boiling point.			
e	I know that, in Group 7, the reactivity of the elements decreases going down the group.			
f	I can describe how a more reactive halogen can displace a less reactive halogen from an aqueous solution of its salt.			
g	I can explain how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms.			
h	I can predict properties from given trends down the group.			

4.1.3. Properties of Transition Metals (Chemistry Only)

4.1.3.1. Comparison with Group 1 Elements (Chemistry Only)

a	I know that Cr, Mn, Fe, Co, Ni and Cu are transition elements.			
b	I know that the transition elements are metals with similar properties which are different from those of the elements in Group 1.			
c	I can describe the difference of transition elements, compared with Group 1, in melting points, densities, strength, hardness and reactivity with oxygen, water and halogens.			

4.1.3.2. Typical Properties (Chemistry Only)

a	I know that many transition elements (Cr, Mn, Fe, Co, Ni and Cu) have ions with different charges, form coloured compounds and are useful as catalysts.			