**O3.2\_Lesson plan\_Chemistry\_Aluminium**

**Age group/class:** 14-15 years old / 8th grade

**Lesson title:** Aluminium

**School Discipline:** Chemistry

**Key concepts:** physical properties, chemical properties, chemical reaction, compound

**Aims:**

- understand the physical and chemical properties of aluminium

- understand the behaviour of aluminium in chemical reactions

- write the chemical reactions of aluminium and various chemical compounds

**Skills developed**: observation, description, analysis, research and collaboration

**Materials/Equipment needed**:

-the periodic table

-notebook

-worksheets

-chemical compounds – Al (aluminium foil), HCl (hydrochloric acid)

-laboratory tools and utensils - 1L volumetric flask, flask

-VR headset

-VR resource <https://eloquent-ramanujan-887aa5.netlify.app/chemistry-5.html>

**Lesson plan:**

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| **Stages** | **Description of activity** | **Time** |
| **Preparation before the lesson** | Learners will have already learned about the periodic table and the various categories of elements and their properties. This lesson focusses on the physical and chemical properties of aluminium, as well as its behaviour in chemical reactions.  If this is a first VR experience for students – go through the safety rules:  -Learners are to sit down whilst using the VR glasses and not hold anything in their hands, unless the experience is of such a nature that it requires you standing, in which case, ensure enough space is allowed around all students.  -Learners will be told to expect a feeling of vertigo. If it gets worse, students must remove VR glasses.  -Learners need to know how to adjust the viewing focus before using the headsets.  -Learners must not use the headset when they are: tired, need sleep, under emotional stress or anxiety, when suffering from cold, flu, headaches, migraines as this can worsen their susceptibility to adverse reactions.  -Learners should be given the choice to opt out of using VR. | - |
| **Introduction** | The teacher presents the theoretical part of the lesson:  Aluminium has been known since ancient times. The name of aluminium comes from the Latin word "alumen" given to an aluminium compound.  Chemical properties:  Aluminum has the symbol Al.  Atomic number and weight:  Z=13, A=27  P+ =13  e- =13, n0 =27-13 =14  Electronic configuration:  K=2e-  L=8e-  M=3e-  Position in the periodic table of elements:  Group IIIA  3rd period  Ionization:  Al – 3e- → Al3+ (positive ion, electropositive character, metal)  Physical properties:  Aluminium is the most widespread metal in the Earth's crust (7.5%), being the third of all chemical elements. It is found in nature in the form of compounds such as: aluminium silicates, bauxite, cryolite, topaz and aluminium oxide, which can be colourless (corundum) or differently coloured (sapphire and ruby).  Aluminium is a silver-white metal of low density and melts at 660oC. It is good conductor of heat and electricity. It is a soft, malleable and ductile metal. It dissolves at high temperature in other metals, forming light alloys. Due to the fact that it is a light metal, it is used in the aviation industry. | 15’ |
| **Initial Immersive Experience** | The teacher announces the students that they will be identifying a substance based on its chemical reaction with Al. They will not be told from the beginning what the substance is, they will have to choose from a list presented after viewing the VR material.  Learners put on the VR headsets and explore the material at their own pace for about 2 minutes: <https://eloquent-ramanujan-887aa5.netlify.app/chemistry-5.html>  Turn the headsets off and bring students back into the classroom.  The students will have to describe, in as much detail as possible, the reaction between the aluminium foil and the other substance – intensity, speed, notable events, chemical products etc. | 10’ |
| **Guided Immersive Experience** | The teacher will present the learners with a number of chemical reactions with aluminium or aluminium compounds. The learners will have to decide which other substances were part of the chemical reaction, based on the reactants and products identified, as well as their known behaviour.  4Al +3O2 → 2Al2O3  2Al + 3Cl2 → 2AlCl3  2Al + 3S → Al2S3  2Al + N2 → 2AlN  4Al + 3C → Al4C3  2Al + 6HCl → 2AlCl3 + 3H2↑  2Al + 3H2O(g) →Al2O3 + 3H2↑  2Al + 3CuSO4 → Al2(SO4)3 + 3Cu  Al + 3AgNO3 → Al(NO3)3 + 3Ag  2Al + Fe2O3 → Al2O3 + 2Fe  4Al + 3CO2 → 2Al2O3 + 3C | 10’ |
| **Follow up** | The teacher presents the chemical reaction between the aluminium foil (Al and Al2O3) and hydrochloric acid (HCl), which results in a violent oxidation of the resulting hydrogen.  The chlorination reaction of aluminium occurs by treating an aluminium foil (Al and Al2O3) with hydrochloric acid (HCl). As a result of this reaction, hydrogen is released, which can be captured in a balloon. We can verify that the gas formed is hydrogen by igniting the balloon. The violent, even explosive, flame reaction indicates the presence of hydrogen in the balloon. The mixture between oxygen and hydrogen is also called a detonating mixture.  2Al + 6HCl → 2AlCl3 + 3H2  Al2O3 + 6HCl → 2AlCl3 + 3H2O  2H2 + O2 → H2O | 5’ |
| **Formative Assessment** | The teacher distributes, at random, worksheets with chemical reactions in which Al is a reactant / part of a reactant. The chemical reactions do not have coefficients or subscripts. The students will have to balance the chemical reactions by adding the correct coefficients and subscripts. | 10’ |