**O3.2 Lesson Plan -** Acid-Base Titration

**Age group/class:** 16-17 years old/ Year 11

**Lesson title:** Acid-Base Titration

**School Discipline:** Chemistry

**Key concepts:** acid-base titration, equivalence point

**Aims:**

- To determine the concentration of an acid solution by performing an acid-base titration. In this example, an aqueous solution of NaOH, 0.1 mol/dm3, will be added to an aqueous solution of HCl of unknown concentration.

**Skills developed**:

The VR resource applied in this lesson plan demonstrates a titration experiment running in the laboratory environment, allowing students to become more familiar with the material needed and the following aspects of the experimental procedure

- Use of glass laboratory equipment to transfer liquids (cylinder, and graduated pipette);

- Use a burette to carry out the titration.

- Measure the pH using an electrode.

This resource can be used before the actual experimental procedure.

**Materials/Equipment needed**:

- Computer with video projector;

- VR glasses;

- VR video/link: <https://eloquent-ramanujan-887aa5.netlify.app/acidbase>

**Lesson plan:**

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| **Stages** | **Description of activity** | **Time** |
| **Preparation before the lesson** | Introducing students to VR glasses if this is their first VR experience.  Proper and safe use of VR glasses.  Potential adverse effects of VR glasses.  Students should be given the choice to opt out of using VR. |  |
| **Introduction** | The students are introduced to the main objective of the class:  - To determine the concentration of an acid solution (HCl) by adding a basic solution of NaOH of known concentration.  Real-life examples of the application of this chemical analysis are given.  Some important concepts are revised:  - The neutralization reaction between HCl and NaOH.  - Equivalence point.  - Acid-base indicators.  - Titration curve.  The students read the list of material and the experimental protocol. | 15 min.  5 min |
| **Guided**  **Immersive**  **Experience** | The students put on the VR headsets to explore the first part of the video and visualize all the material and chemical compounds needed for the experiment.  Turn the headsets off and bring students back into the classroom.  - the students compare the list of material of the protocol with the material available on the video.  The students put on the VR headsets to explore the second part of the video and visualize the experimental procedure.  Turn the headsets off and bring students back into the classroom.  - the students revise the experimental protocol seen on the video.  **Class discussion on:**  - Chemistry safety rules.  - Experimental protocol steps. | 2 min.  5 min.  3 min.  5 min |
| **Follow up** | The teacher provides a table with the results obtained in the VR experiment (pH versus added volume). Students in groups draw the titration curve and graphically determine the pH at the equivalence point (using written guidelines) and the concentration of the acid.  Each group presents their results. | 15 min. |
| **Formative assessment** | Teacher collects the groups calculations and correct them, if necessary. | 5 min. |