At the start of the VR laboratory

1. In the start before showing the menu we must show this list of instructions.

Instructions

- Wear your protective equipment: gloves, goggles, and a lab coat.
- Wash and disinfect your hands before handling any equipment or samples.
- Ensure the workstation is clean and organized.
- Verify that all necessary tools and materials (beakers, pipettes, multiparameter meter, bottles, etc.) are available.
- Disinfect and rinse all equipment before use, especially glassware.
- Label all bottles and containers properly to avoid confusion during the experiment.
- Calibrate all instruments (e.g., multiparameter meter, spectrophotometer) according to the protocol.
- Check that devices are working and properly configured for the procedure.
- Use freshly cleaned or sterile equipment to avoid contamination.
- Handle samples with care and store them properly if not analyzed immediately (e.g., in a cooler).
- Do not touch your face or personal items (phones, etc.) during the lab work.
- Report spills, accidents, or unusual incidents immediately to the supervisor.
- Log all steps and observations accurately in the lab notebook or software.

Bring equipment from laboratory

1. Add the steps for preparing bottles for sampling
    i. Disinfection.

    *not yet finished details in this point, I will update

    ii. rinsing the equipment.

    *not yet finished details in this point, I will update

    iii. labeling.

*not yet finished details in this point, I will update

2. Add multi-parameter device calibration.

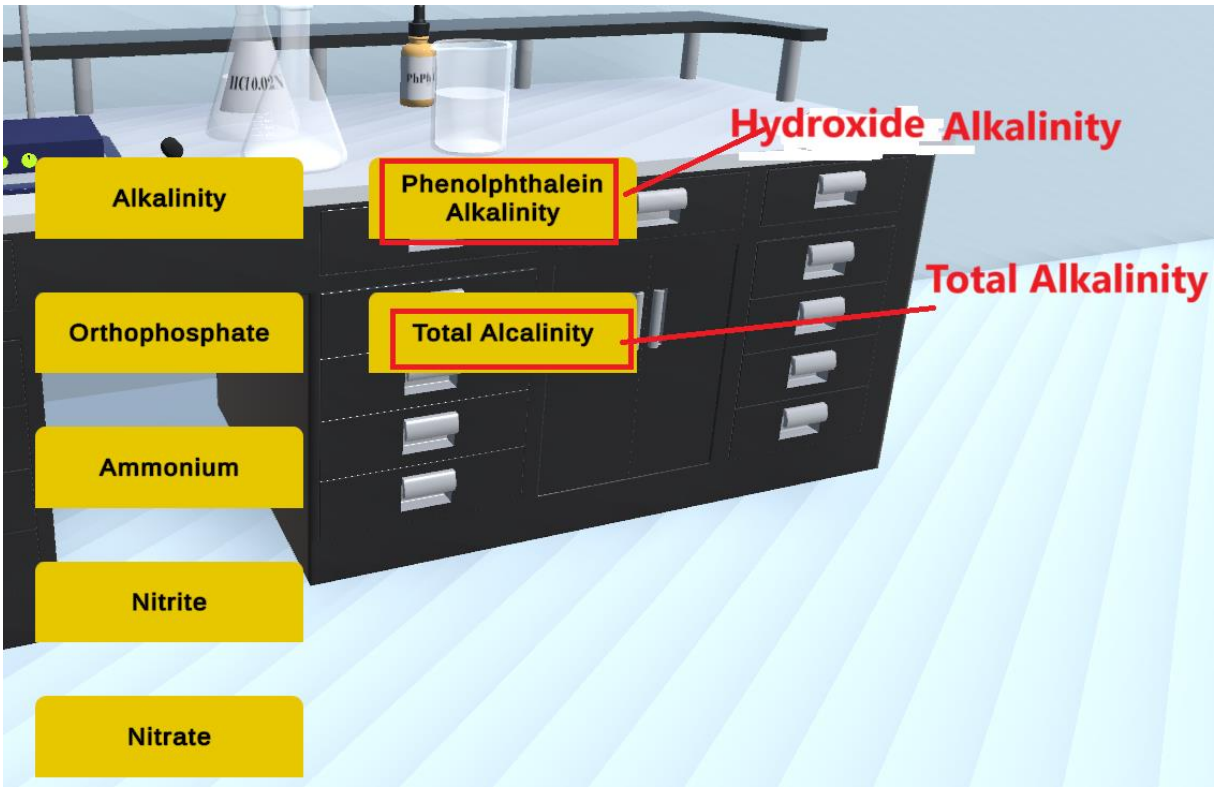
*not yet finished details in this point, I will update

Sampling

1. Remove the step of labeling the bottles in river, cause this step will be done in laboratory brings equipment. (In the river we will take measurements then take a sample water using sample bottle then store it in the cooler, I know that in the audio we say label it and store we will update the audio after.)
2. Add a step of "**Rinse the sample bottle before sampling (repeat 3 times)"** from the river: in the river after wearing glove and before take measurements, add a step of rinse the sample bottle before sampling, it will be repeated 3 times, mean when we click first, we see a bottle that it will be filled by the sample water and emptied then we click second time same thing and third time then after that we will do the measurements then taking sample water.
    - We can rinse a bottle in a different position from the one we take the sample.
    - Please watch this video from 1:42 to 3:30 to clearly understand the required: https://youtu.be/x_L9zM0l2uI?t=103

Menu of the application

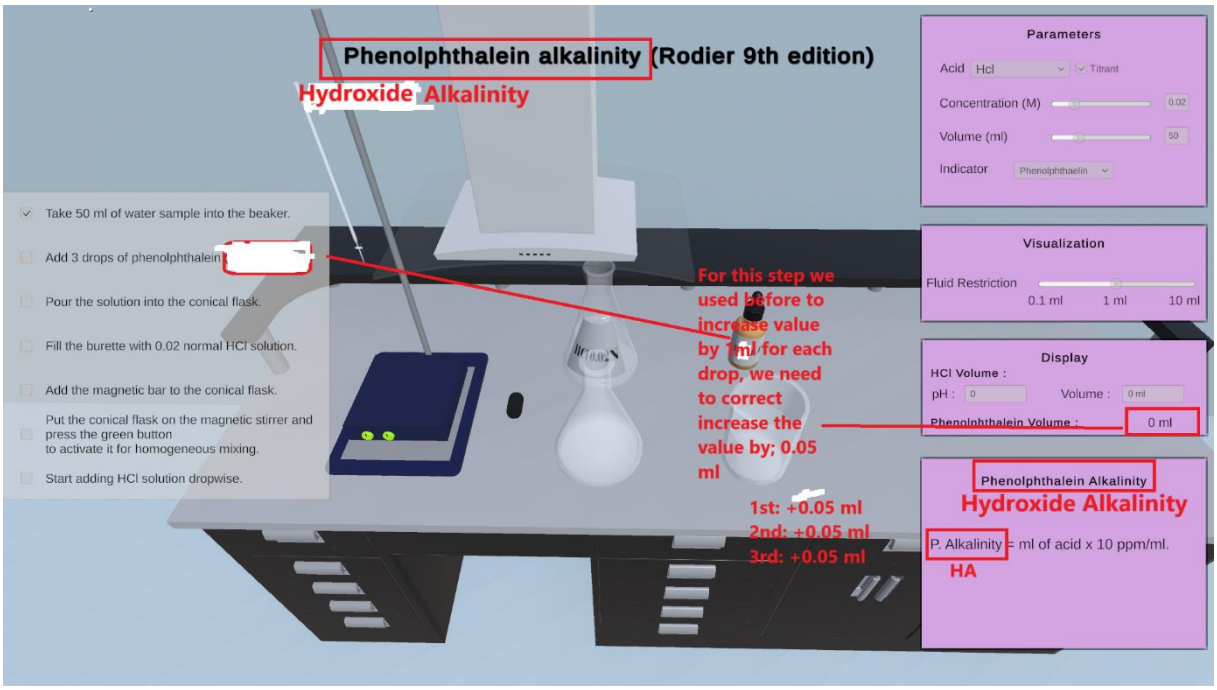
1. Correct the text of menu mentioned in images below
    - Change "phenolphthalein alkalinity**"** by "**Hydroxide Alkalinity**", and "Total Alcalinity" by "**Total Alkalinity**"



First experience (Hydroxide alkalinity)

1. Correct texts mentioned in the image below.

For the second step which is add 3 drops of phenolphthalein, for every step we need to update the **phenolphthalein** volume added **by 0.05 ml** (3 times = in total we will in volume added **0.15 ml**)



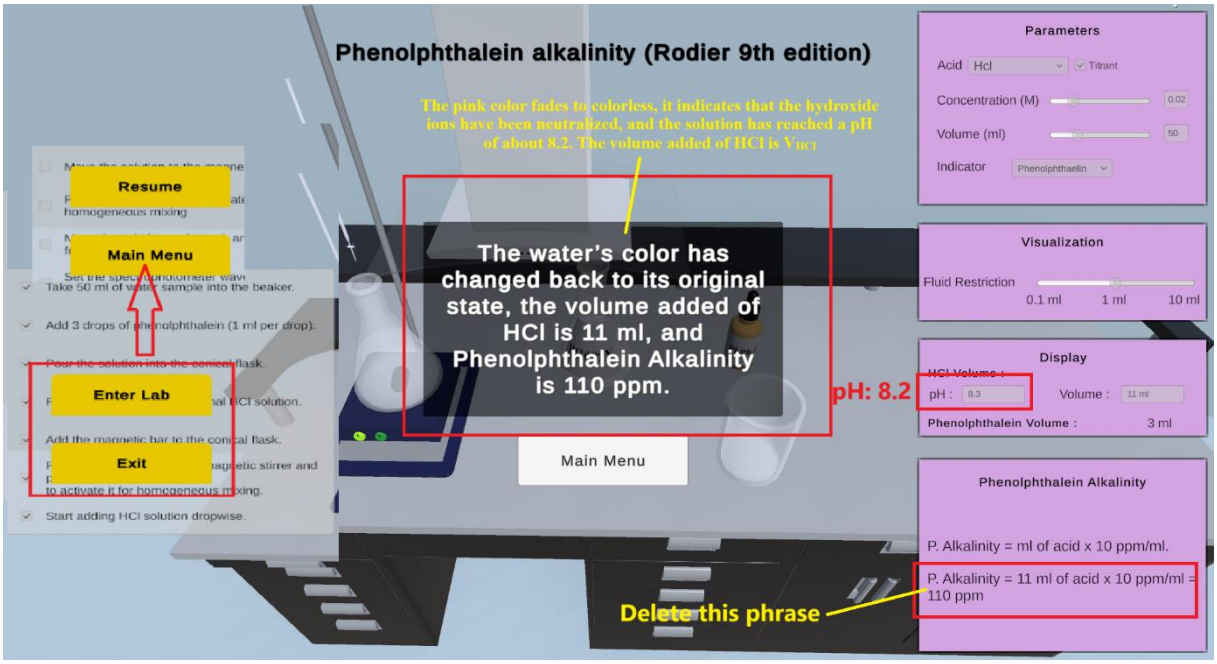
2. Change the menu when clicking in "**esc**" in experience 1 to the following:

   Resume

   Main menu

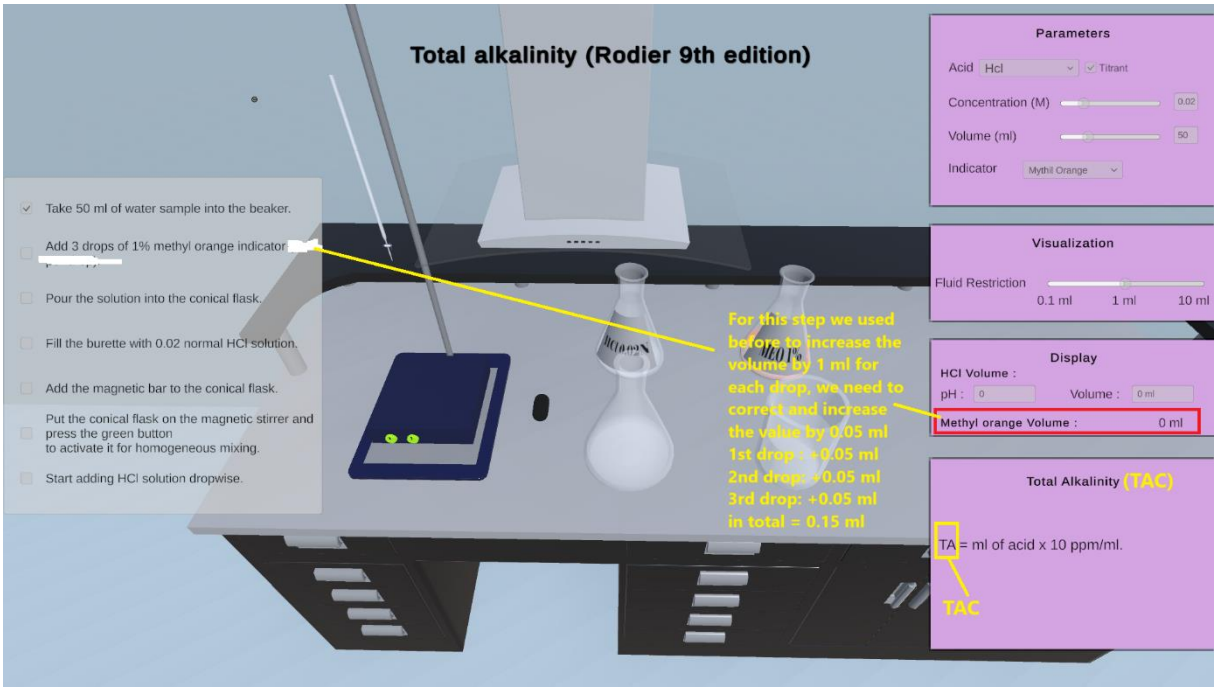
3. Correct Errors in text last message and in the result window (see the image below)

Last message: "The pink color fades to **colorless**, it indicates that the hydroxide ions have been neutralized, and the solution has reached a **pH of about 8.2.** The volume added of HCl is V_{HCl}"



second experience (Total alkalinity)

1. For the second step which is add 3 drops of 1% of methyl orange indicator, for every step we need to update the Methyl orange volume added by 0.05 ml (3 times = in total we will in volume added 0.15 ml).



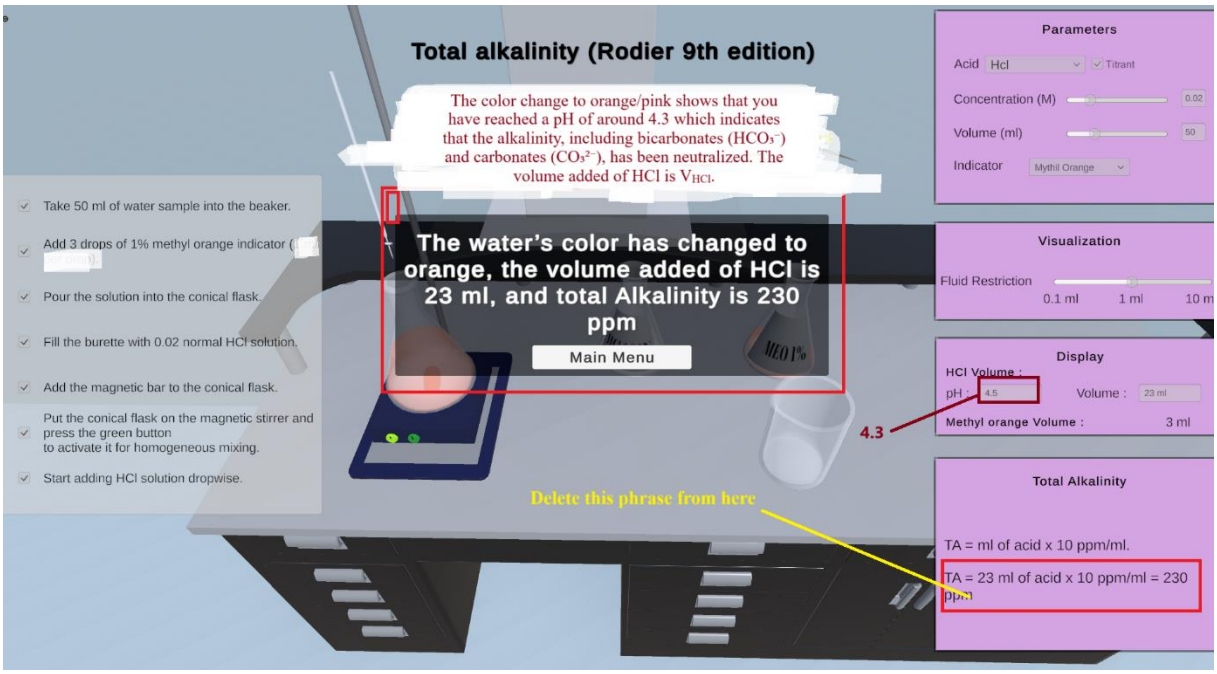
2. Change the menu when clicking in "**esc**" in experience 1 to the following:

   Resume

   Main menu

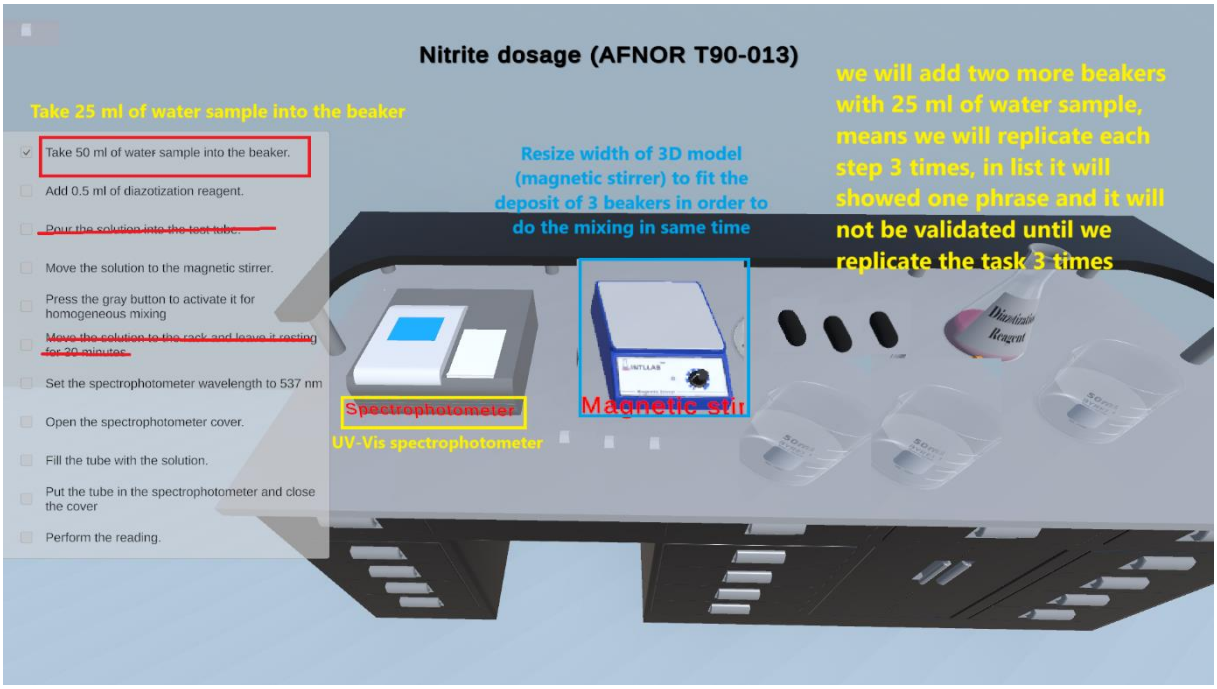
4. Correct Errors in text last message and in the result window

Last message: "The color change to **orange/pink** shows that you have reached a **pH of around 4.3** which indicates that the alkalinity, including bicarbonates (HCO_3^-) and carbonates (CO_3^{2-}), has been neutralized. The volume added of HCl is V_{HCl}."



Nitrite experience

1. Update objects 3D models as mentioned in the image below



- We need to add 2 more beakers (in total we will have 3).
- We need to add 2 more magnetic bar (in total we will have 3).
- Replace this object: **vortex** by the **magnetic stirrer** showed in the image and resize it to fit the 3 beakers deposit.

2. Update the list of tasks in nitrate experience.

- For tasks who needed to be replicated 3 times, it will not be validated (checked) until we finish the 3 replicates.

- ☐ Take 25 mL of the water sample and pour it into a beaker (repeat 3 times)
- ☐ Add 0.5 mL of the diazotization reagent to the sample (repeat 3 times)
- ☐ Place a magnetic stir bar in each beaker (repeat 3 times).
- ☐ Place the beakers on the magnetic stirrer.
- ☐ Press the button to activate stirring for homogeneous mixing**.**
- ☐ Allow the solutions to rest for 30 minutes**.**

After 30 minute (in the application we estimate this time by 6 seconds or 7 seconds) we should see that the color has changed to **#ead4e4**

- ☐ Set the spectrophotometer wavelength to 537 nm.
- ☐ Fill the cuvette with the solution (repeat 3 times).
- ☐ Open the spectrophotometer cover.
- ☐ Place the cuvette in the spectrophotometer and close the cover.
- ☐ Perform the reading.

The last 3 steps will be replicated 3 times, means for each tub we will open the spectrophotometer cover and put the tub, read the value then after open the cover, extract the tub then put the other one. We will add a table where we will display the values of the 3 measures in sequence (once we read a value we add it to table (*3))

Table:

Sample Replicate	Wavelength (nm)	Absorbance Reading (OD)
Replicate 1	537	1.5
Replicate 2	537	1.7
Replicate 3	537	1.6

3. After updating list of tasks, we need to update the last message we show:
   New message: The absorbance of the test solution in the spectrometer is OD. The nitrite concentration [NO_2^-] of the sample is expressed in milligrams per liter and given by the expression: [NO_2^-] = $\frac{OD}{\epsilon.l}$

Orthophosphate experience

*not yet finished details in this point, I will update

Ammonium experience

*not yet finished details in this point, I will update