VIRTUAL CHEMISTRY PRACTICALS AT OBAFEMI AWOLOWO UNIVERSITY, NIGERIA

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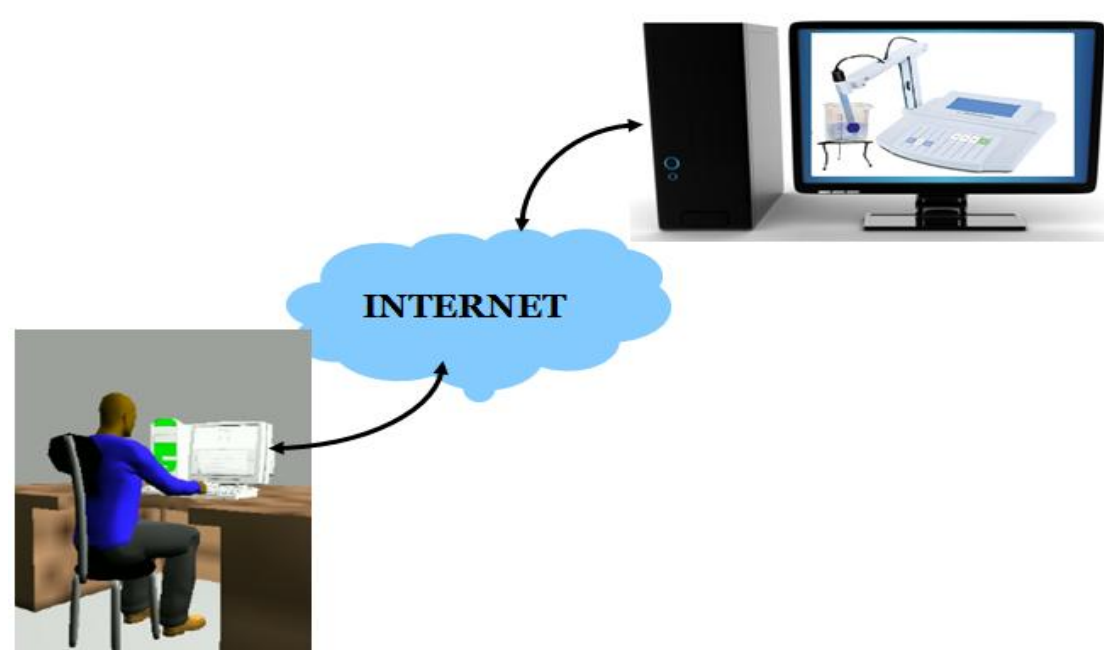
BACKGROUND

- Over 25,000 student population at the Obafemi Awolowo University (Nigeria),
- About 4,200 students take one form of undergraduate practical chemistry or the other.
- Overcrowded Labs Due to lack of adequate laboratory equipment and supplies
- Regular practical classes supplemented by virtual experiments.
- Collaboration between the chemistry group and the software engineering group of the University.

SOLUTION: VIRTUAL EXPERIMENTS

EXPERIMENTS DESIGNED
- Experiments designed with the support of the Wolfson foundation.
  - Chloride Determination
  - Conductivity Determination
  - Recrystallization and Melting point Determination

INTERNET

ULTIMATE GOAL
- Ensure that students get almost all the expected learning outcomes in a real lab, from the virtual lab.

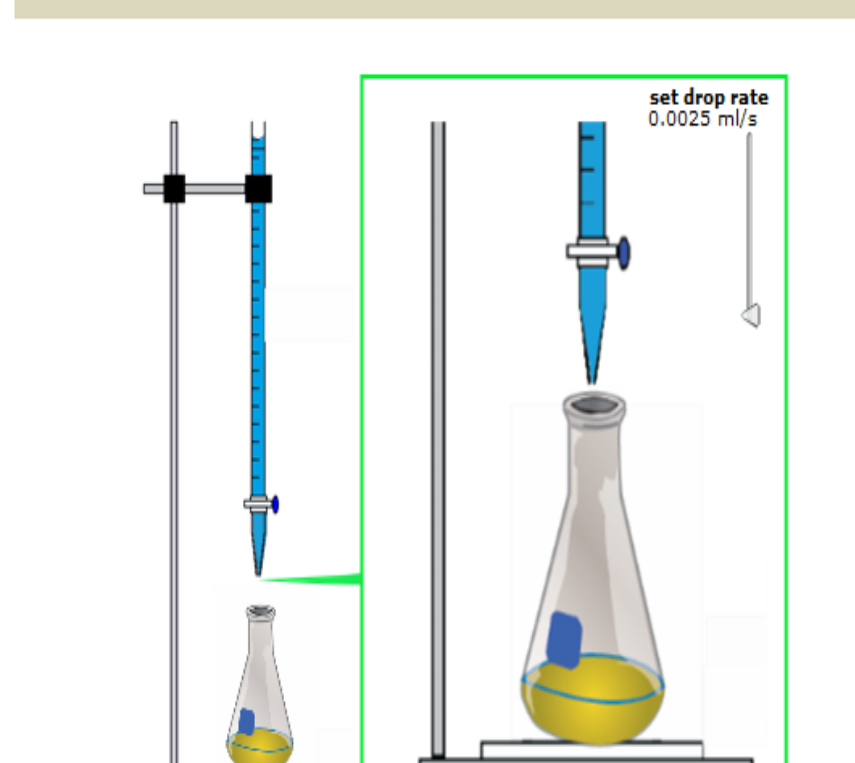## DESIGN PROCESS FOR VIRTUAL EXPERIMENTS

- Chemist: Prepare a story board for each experiment
  - The story board tells the procedure for carrying out the experiment
- Chemist: Obtain / determine the mathematical models for each experiment
  - For example, the equation relating the solubility of a solute to the mass of the solute, the volume of the solvent and the temperature.
- Software developer: Design graphic objects for each experiment
- Software developer: Design the Adobe Flash movie for each experiment
- Chemist: Test the developed virtual lab for consistency with science
- Chemist and Software Developer: Improve designed lab for better pedagogic value if necessary

CHLORIDE MEASUREMENT

- To determine chloride content of a provided water sample

Chloride Measurement Experiment
Apparatus Bench

set drop rate 0.0025 ml/s

Lab Assistant
To add the silver nitrate, first set the DROP-RATE using the vertical slider. The default drop rate is 0.5ml

Then, hold down the mouse on the zoomed-burette tap to add the silver nitrate. With the mouse down, an amount of silver nitrate is added at the set drop rate. On mouse up, the silver nitrate stops.

Continue adding until the colour of the solution changes gradually from yellow to reddish-brown; Once the solution changes to reddish-brown, click on the proceed button

Need more help? click here

ELECTRICAL CONDUCTIVITY MEASUREMENT

- To determine the electrical conductivity of a provided water sample

Electrical Conductivity Measurement
Apparatus Bench

Lab Assistant
Standard Solution Selected: KCl with EC value of 1410 µS/cm

Proceed

Calibrate the conductivity meter by adjusting the reading of the meter to the appropriate value. Use the two blue buttons on the Conductivity meter to adjust the readings appropriately.

Make sure you set the Conductivity on the meter to that on the standard solution you selected. Double-click to discreetly increment in steps of 1 or hold down the mouse to rapidly increment in steps of 0.1. One you are done calibrating, click the proceed button.

Need more help? click here

Conductivity Meter

RECRYSTALIZATION AND MELTING POINT DETERMINATION

- To purify a given crystalline sample via recrystallization method
- To determine the given sample by obtaining purified sample's boiling point

Recrystallization and Melting Point Determination Experiment   Watch Video Demonstration
Apparatus Bench

Solute A (5g)   Solute B (5g)   Solute C (5g)   Water (b.p 100)   Ethanol (b.p 78)   Acetone (b.p 56)

Lab Assistant
Howdy. I am Brainy and I am your guide throughout the experiment.

1. You have been given 5g of solute sample. Select it by dragging the Petri dish labeled Solute from the Apparatus Bench onto the Solute Beaker.
2. Select any of the Solvents from the Apparatus Bench by dragging the Solvent from the Apparatus Bench onto the Solvent Beaker.
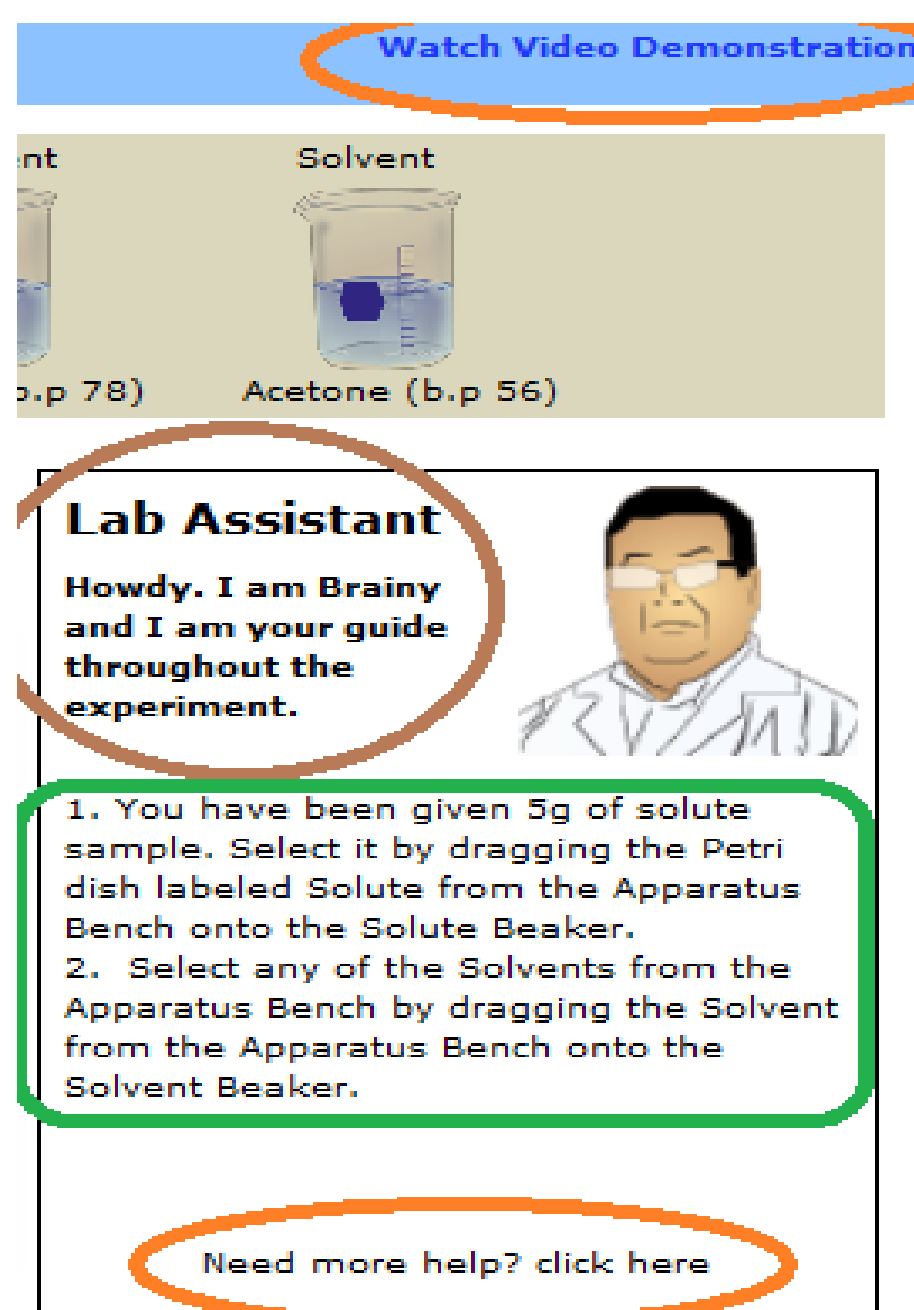
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Heater   Solute Beaker   Solvent Beaker

GENERAL FEATURES OF THE VIRTUAL EXPERIMENTS

- An apparatus bench containing the materials and equipment for each experiment

Apparatus Bench   Solvent
Solute A (5g)   Solute B (5g)   Solute C (5g)   Water (b.p 100)

Watch Video Demonstration
Solvent
p 78)   Acetone (b.p 56)

- A step-by-step set of instructions given by a 'virtual laboratory assistant'

- Instruction to proceed to the next step on the successful execution of each operation

- A help guide describing the theory and procedure for performing each experiment in real laboratory

  (and video for recrystallization experiment)

Lab Assistant
Howdy. I am Brainy and I am your guide throughout the experiment.

1. You have been given 5g of solute sample. Select it by dragging the Petri dish labeled Solute from the Apparatus Bench onto the Solute Beaker.
2. Select any of the Solvents from the Apparatus Bench by dragging the Solvent from the Apparatus Bench onto the Solvent Beaker.

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6:13 / 9:18
recrystallisation and melting point determination Experiment
RO-Lab O.A.U   73 views

CONCLUSION

The effectiveness of this method will be evaluated soon after its launching. The feedback mechanism will help to provide some measure of quality control to the whole virtual experimentation process.

- Pilot test of each virtual experiment by a select group of students who have previously carried out the same experiments in the real laboratory
- Pilot test of each virtual experiment by another set of students prior to doing the same experiments in the real laboratory
- Testing of each virtual experiment by instructors who normally supervise these experiments in real laboratory
- Feedback from the two sets of students on their learning experience as well as the instructors
- Refinement of the virtual experiments based on the feedback
- Use of the refined virtual experiments as supplements to real experiments at OAU and eventually at other Nigerian Universities