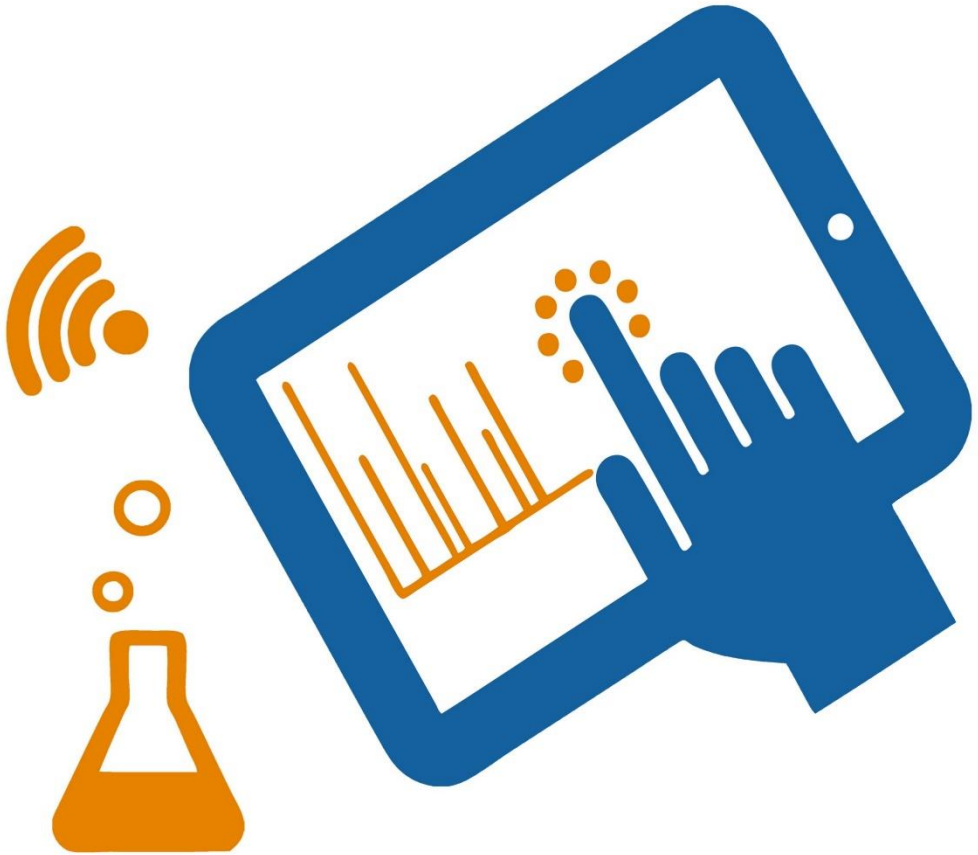
Erasmus+



NETCHEM

Remote Access service – NETCHEM web-site presentation

Dr Tatjana Andjelković (UN)/Dr Milan Milosevic (UN)
University of Nis Faculty of Science and Mathematics

ICT Networking for Overcoming Technical and Social Barriers in Instrumental Analytical Chemistry Education

Programme:	Erasmus +
Key action:	Cooperation for innovation and the exchange of good practices
Action:	Capacity Building in Higher Education
Acronym:	NETCHEM
Ref. No:	573885-EPP-1-2016-1-RS-EPPKA2-CBHE-JP

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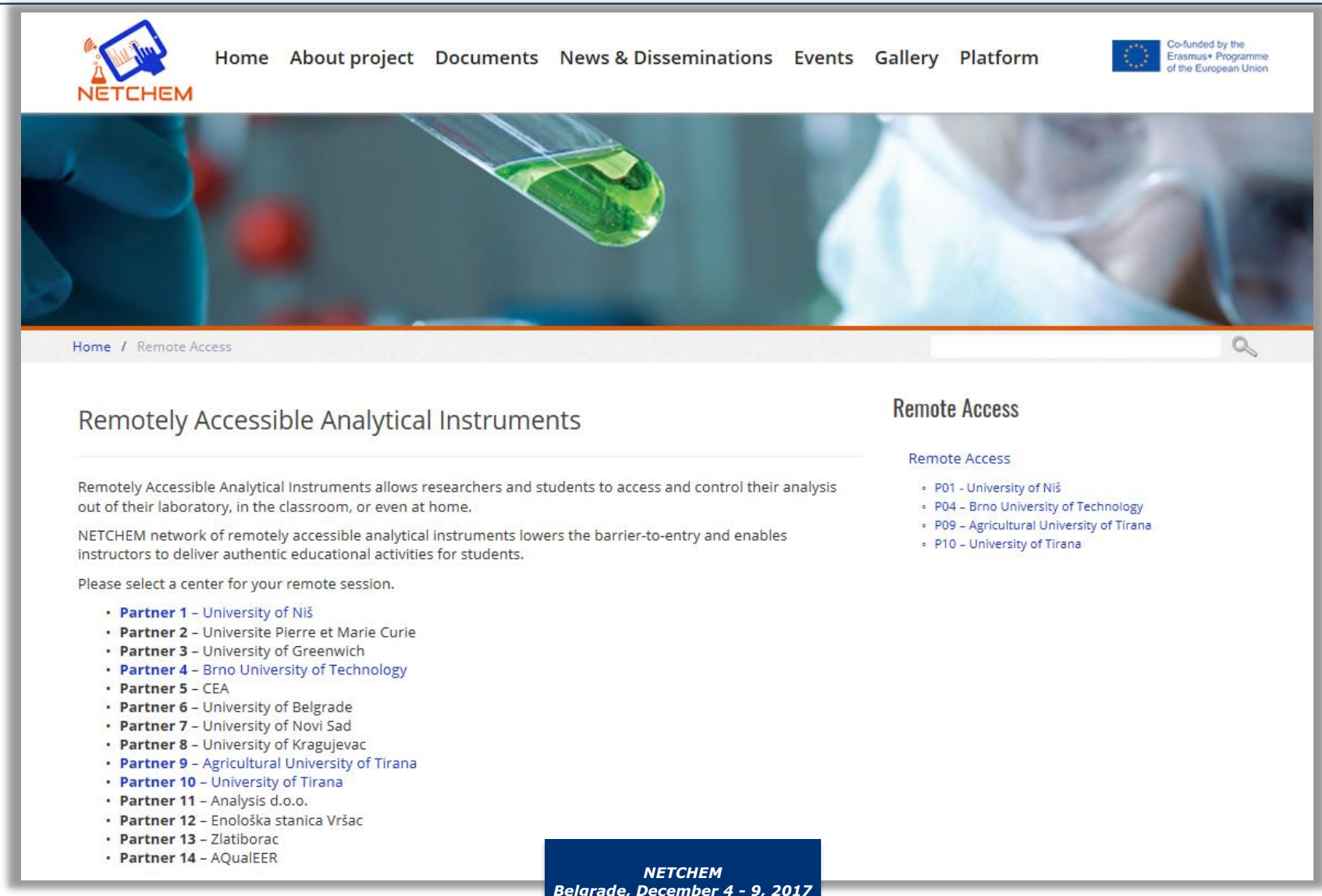

NETCHEM

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Co-funded by the Erasmus+ Programme of the European Union

Home / Remote Access

Remotely Accessible Analytical Instruments

Remotely Accessible Analytical Instruments allows researchers and students to access and control their analysis out of their laboratory, in the classroom, or even at home.

NETCHEM network of remotely accessible analytical instruments lowers the barrier-to-entry and enables instructors to deliver authentic educational activities for students.

Please select a center for your remote session.

- **Partner 1** – University of Niš
- **Partner 2** – Universite Pierre et Marie Curie
- **Partner 3** – University of Greenwich
- **Partner 4** – Brno University of Technology
- **Partner 5** – CEA
- **Partner 6** – University of Belgrade
- **Partner 7** – University of Novi Sad
- **Partner 8** – University of Kragujevac
- **Partner 9** – Agricultural University of Tirana
- **Partner 10** – University of Tirana
- **Partner 11** – Analysis d.o.o.
- **Partner 12** – Enološka stanica Vršac
- **Partner 13** – Zlatiborac
- **Partner 14** – AQualEER

Remote Access

Remote Access

- P01 - University of Niš
- P04 – Brno University of Technology
- P09 – Agricultural University of Tirana
- P10 – University of Tirana

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Partner 1 – University of Niš

Analytical Instruments available for remote access:

- GC-MS
- ESI-MS Decca
- ESI-MS Advantage
- HPLC + ESI-MS LTQ Orbitrap
- UV-VIS
- AAS

Contact for remote session: Darko Anđelković

e-mail: darko.andjel@outlook.com

Remote Session Request

GC-MS (Gas chromatography – mass spectrometry)

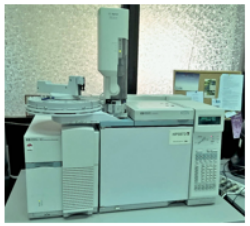
- GC: Hewlett Packard 6890 series GC System with autosampler
- MSD: Agilent 5973 Mass Selective Detector (Electron Ionization MSD-EI, single quadrupole)
- Column: HP DB5 non-polar & several others capillary columns

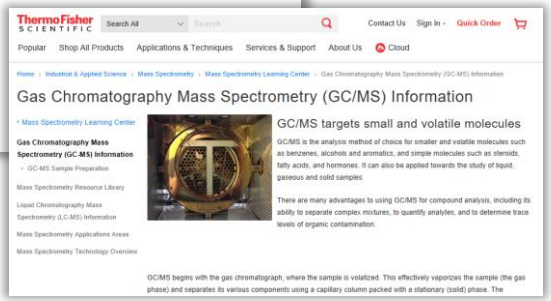
GC-MS is the analysis method of choice for smaller and volatile molecules such as benzenes, alcohols and aromatics, and simple molecules such as steroids, fatty acids, and hormones. It can also be applied towards the study of liquid, gaseous and solid samples.

There are many advantages to using GC-MS for compound analysis, including its ability to separate complex mixtures, to quantify analytes, and to determine trace levels of organic contamination.

The Agilent 6890 is a leading GC system with state of the art dynamic temperature programming, EPC pneumatics and flow controls. The 6890 comes equipped with a split-splitless injection system that supports a wide variety of sample introduction techniques including thermal desorption, on-column injection, solid-phase micro-extraction (SPME), direct headspace injection, and solvent-based injections. Standard equipment includes a flame ionization detector (FID) ideal for running serial paraffins for retention index determinations. Read more

| Top |





Remote Access center mailing address:
Faculty of Science and Mathematics
Visegradska 33 , 18000 Nis, Serbia

Remote Session request

* First Name :

* Last Name :

* Email Address :

* Institution :

* Phone :

* City :

* State :

* Zip :

* Country :

Select the instrument you would like to use for Remote Session:

- GC-MS
- ESI-MS Decca
- ESI-MS Advantage
- HPLC + ESI-MS LTQ Orbitrap
- UV-VIS
- AAS

Institution type:

- High School
- University
- Enterprise

Approximately how many participants will participate?

- 5 or less
- 5 to 10
- 10 to 20
- 20 to 25
- More than 25

Select a date and time (Eastern Time Zone) for your remote test date:

Month

Day

Year

Hrs.

Mins.

AM/PM

Select a date and time (Eastern Time Zone) for your remote access lesson:

Month

Day

Year

Hrs.

Mins.

AM/PM

Approximately, how much time would you like to allocate for this remote lesson session?

30 min to 1 hour

1-2 hours

> 3 hours

What area of science background do your participants have?

Unknown, mixed audience

Chemistry

Biology

Physics

Engeneering

What level of science background do your participants have?

High school

BSc

MSc

PhD

Did you install the Team Viewer software onto the computer you are using for the remote session?

Yes

No, it will be installed before the remote test

No, I would like help downloading and installing the software

What type of samples would like to analyze during remote access? Please describe.

Would you like to mail in your own samples? Please describe.

Briefly describe your learning objective(s) for the remote activity:

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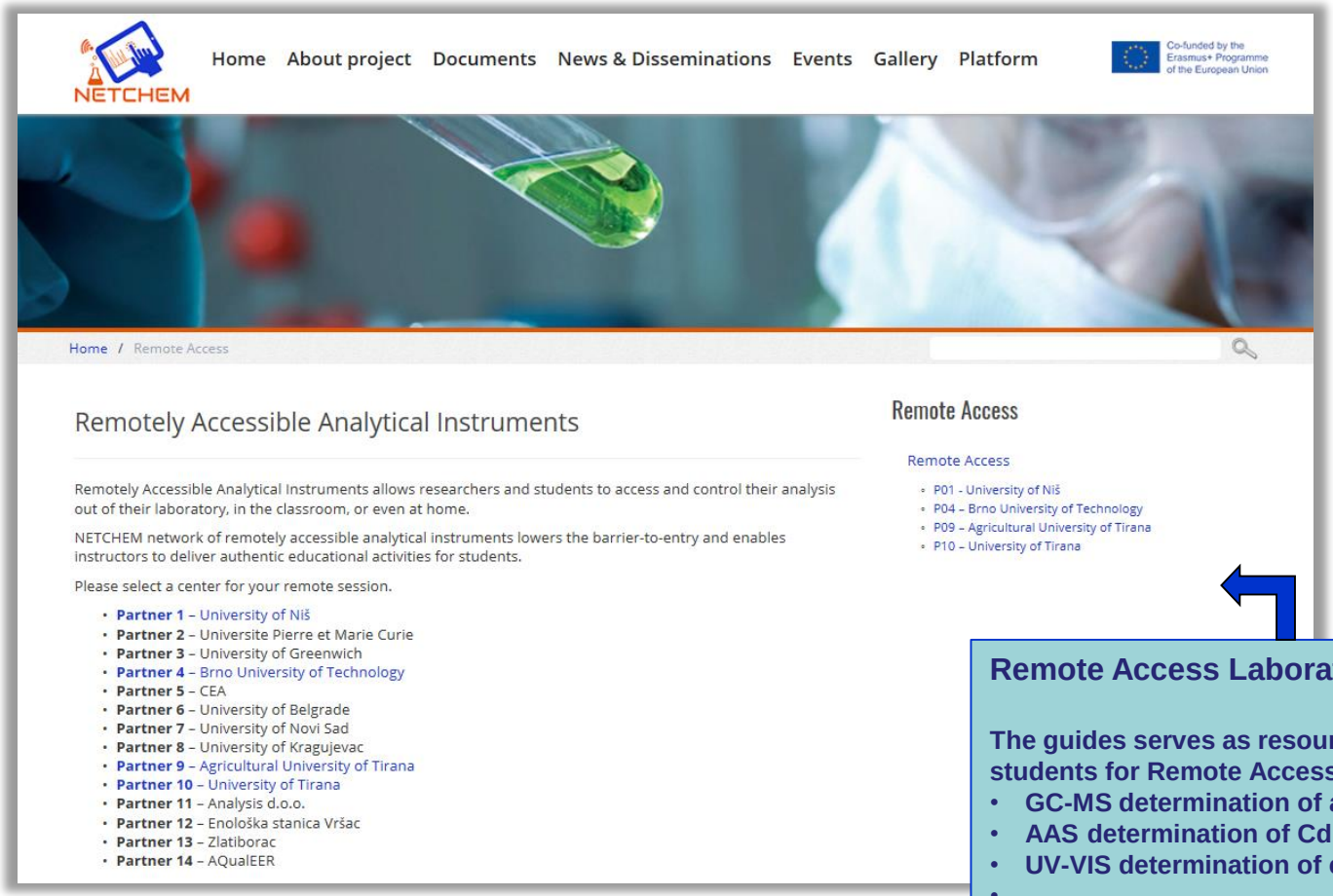


Remote Access Laboratory Guides

The guides serves as resource for preparing students for Remote Access Lab Exercise

- **GC-MS determination of atrazine**
- **AAS determination of Cd in tea**
- **UV-VIS determination of caffeine in soft drinks**
- **….**

NETCHEM Remote Access Laboratory Guide

UV-VIS determination of caffeine in soft drinks

In this exercise, you will:

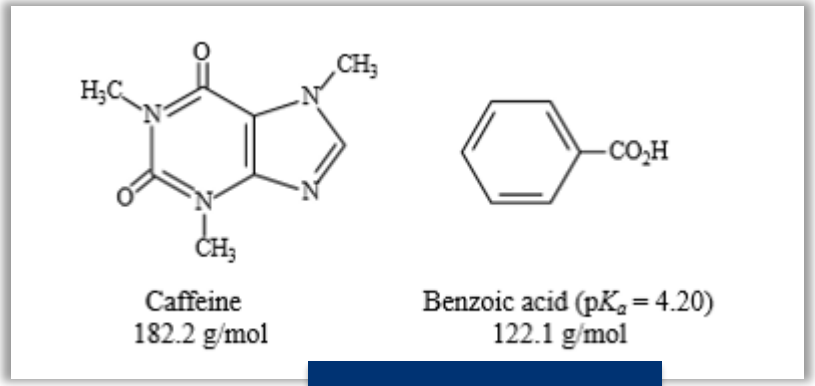
- Measure …..
- Measure …..
- Perform chemical analysis ….
- Calculate the concentration….
- Gain experience in GC-MS usage

Background

In this experiment, we use ultraviolet absorbance to measure two major species in soft drinks. Caffeine is added as a stimulant and sodium benzoate is a preservative. Benzoic acid was the first chemical preservative allowed in foods by the USA Food & Drug Administration (FDA) and it is widely used in acidic foods (pH 2.5 - 4).

In South Africa, soft drinks are permitted to contain a maximum of 400 mg/L benzoic acid. It is normally added as the salt, sodium benzoate, as is this is approximately 200 times more soluble in water. (At pH 2.5, what will be the predominant form, benzoic acid or benzoate?)

Although benzoic acid is a man-made food additive, benzoic acid can occur naturally in several fruits e.g. Scandinavian cloudberry, which has several times the FDA legal limit!



Beer's law

Beer's law also applies to a medium containing more than one kind of absorbing substance. Provided there is no interaction among the various species, the total absorbance for a multicomponent system is given by:

A total = A1 + A2 + ….. + An (Equation 1)

A total = □1bc1 + □2bc2 + ….. + □nbcn

where the subscripts refer to absorbing components 1, 2, …n.

The above equation indicates that the total absorbance of a solution at a given wavelength is equal to the sum of the absorbances of the individual components present. This relationship makes possible the quantitative determination of the individual constituents of a mixture, even if their spectra overlap. If enough spectrometric information is available, all of the components of mixtures can be quantified without separation. For a two-component mixture (compound X and Y) with overlapping absorbances, one could solve for the concentration of each species, [X] and [Y], by measuring the absorbances at two different wavelengths, λ' and λ". The problem is mathematically equivalent to having two simultaneous equations with two unknowns.

A1= □X,1 bcX + □Y,1 bcy (total absorbance at λ') (Equation 2)

A2= □x,2 bcx + □y,2 bcy (total absorbance at λ") (Equation 3)

The four molar absorptivities, □X,1, □Y,1 ,□x,2, □y,2 , can be evaluated from individual standard solutions of X and Y, or better, from the slopes of their Beer's law plots. The problem becomes simpler when one of the compounds has no interference with the other compound. If there is substantial interference then you must solve the simultaneous equations. Using UV spectroscopy, you will determine the concentrations of caffeine and sodium benzoate (determined as benzoic acid), in the soft drink Mountain Dew.

The UV spectra of caffeine and benzoic acid overlap at certain wavelengths, thus you will need to measure the absorbance of the unknown mixtures using two different wavelengths, and apply equations 2 and 3 to evaluate the concentrations of caffeine and benzoic acid. See your textbook for help in carrying out the calculations. The experiment could be shortened by recording just one spectrum of caffeine (20 mg/L) and one of benzoic acid (10 mg/L) and assuming that Beer's law is obeyed. However, we shall construct a calibration graph and carry out a full analysis. Are there advantages for doing this? If yes, please explain.

Reagents Stock solutions: benzoic acid 100 mg /L; caffeine 200 mg /L and 0.10 M HCl

Material

For this lab exercise, you will need the following material :

- ….

Procedure:

I. Calibration standards: Prepare a set of benzoic acid solutions containing 2, 4, 6, 8, and 10 mg/L in 0.010 M HCl. In a similar manner, prepare caffeine standards containing 4, 8, 12, 16, and 20 mg/L in 0.010 M HCl.

II. Soft drink: Warm ~ 20 mL of soft drink in a beaker on a hot plate to expel CO2 and filter the warm liquid through filter paper to remove any particles. After cooling to room temperature, pipette 2.00 mL into a 50-mL volumetric flask. Add 10.0 mL of 0.10 M HCl and dilute to the mark.

III. Verifying Beer's law: Record the ultraviolet spectrum of each of the 10 standards with water in the reference cuvette. Note the wavelength of peak absorbance for benzoic acid (λ′) and the wavelength for the peak absorbance of caffeine (λ′′). Measure the absorbance of each standard at both wavelengths. Prepare a calibration graph of absorbance versus concentration for each compound at each of the two wavelengths. Each graph should go through 0. The slope of the graph is the absorptivity at that wavelength.

IV. Unknowns: Measure the ultraviolet absorption spectrum of the diluted sample of the soft drink. With the absorbance at the wavelengths λ′ and λ′′ determine the concentrations of benzoic acid and caffeine in the original soft drink.

V. You will need to save the data to flash drive so that you can copy the data from the spectrometers in the form of a .csv file. This can then be converted using Microsoft Excel int

Remote Access Connection Instructions

What makes these labs different and unique from other classroom experiments is that we have incorporated a section in each activity to remotely characterize your samples from your classroom.

Request a remote lab session specifying information such as: the day, the time, and the instrument you are interested in using by visiting our web site

http://netchem.ac.rs/remote-access

You will see the list of partners with the instruments provided to chose from.

You will be contacted by a Remote Access staff member to set up a test run to ensure you are set up properly and have the required infrastructure.

Send samples or verify the in-house sample you would like us to prepare and load for characterization.

Send your samples to the Remote Access center that you chose on your request.

There are two communications soft-ware packages, that will allow us to communicate instructions and answer questions during the session.

TeamViewer: You can obtain a free download at:

https://www.teamviewer.com/en/index.aspx

Skype

Remote Access Connection Instructions

You will need:

a) Computer with administrator access to install plug-ins and software

b) An internet connection

c) Speakers

d) Microphone

e) Projector connected to the same computer

f) Web browser (Firefox preferred)

During the test run you can refer to this guide to perform the following steps, but it's very important that you only proceed with these steps during your scheduled times. You may interfere with other remote sessions and potentially damage equipment if you log in at other times.

a) Open and logon to your Zoom/Team-viewer account. You will be given the access code to enter at the time of your test and then again during the remote session.

- If you are using the Zoom software, Remote Access staff will give you the access code.
- If you are using the Team-viewer software, Remote Access staff will give you the ID & password.

b) You should soon see the Remote Access desktop and at this point you can interact with the icons on the screen as if it were your desktop.

c) Switch to full screen mode by selecting the maximize screen option in the top right corner of the screen.

d) Upon completion of the session, move your mouse to the top right corner of the screen, and click on the X to disconnect the remote session. It will ask if you want to end the remote session. Click Yes.

Author and Editor References

This remote access laboratory was created thanks to work done primarily at University of _____

Contributors to this the creation of this laboratory were: _____

Editing into NETCHEM Format and website was completed by: _____

References and Supplemental Material

The NETCHEM platform was established at the University of Nis in 2016-2019 through the Erasmus Programme.

Please contact a NETCHEM representatives at your institution or visit our website for an expanded contact list.

The work included had been led by the NETCHEM staff at your institution.

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.