Vocational educational concept

School	SPŠCH Brno (CZ)	
Field	Vocational education and training	
Vocational fields	1. Applied Chemistry • Analytical Chemistry • Pharmaceutical substances • Environmental Protection 2. Food Analysis	
Vocational field of action	„Work in the chemistry laboratory“	
Unit of learning outcomes (ULO) **Total time in lessons** **(1 lesson = 45 minutes)**	ULO 2: material constants and material properties determine (Physical Chemistry) 3rd year: 34 lessons (1 lessons per week) 4th year: 60 lessons (2 lessons per week)	
Work tasks and time in lessons	1. Determination of kinematic viscosity using the Ubbelohde capillary viscometer 2. Measurement of the molar refraction of the fluids for determining the quality of the raw material 3. Determination of the pH dependence of the biopharmaceutical drug of the concentration	2 lessons 2 lessons 3 lessons
Phases of the learning process	• orientation, theoretical considerations	

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	• actions, practical implementation • monitoring and evaluation of action and results
Didactic features	• Introduction, motivation, action orientation, reactivation, goal orientation • Practical appropriation • consolidate, deepen the skills in operational practice
Evaluation / monitoring / evaluation of results	1. Written controls 2. Oral controls 3. Practical controls 3.1. Work Result 3.2. Product Review

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Learning Outcomes		
Knowledge (theoretical + practical) *Scientific and theoretical context*	***Skills*** *practical + cognitive* *(=application of knowledge)*	***Competence*** *(Role and level of responsibility and autonomy)*
• Knows the properties of the used chemicals (GHS hazard statement) • Describes the relationships between measurement and determination of size and corresponding method (known action steps) and the calculation relations for the determination of physical quantities • Knows appropriate equipment and devices and their operation / handling (analytical balance, stopwatch, viscometer, pycnometer, refractometer, pH meter) • Describes the principles of the procedures and methods (density, viscosity, refraction and pH determination)	• Takes orders for determining physical constants of the liquid samples and plans to further work steps up to the handover of the result • Selects method that appropriate laboratory equipment and chemicals necessary and goes exactly, carefully and routinely order • Performs repeated measurements on the same samples by in order to reach a consensus of consecutive measurements at least three • Performs the measurements with extreme accuracy, with a focus on purity of the equipment used	• Operates independently for work regulations • independently verified results and solutions • Formulated the influence of the monitored parameters (eg., Temperature) to the measured values • Raises potential problems, find alternative measuring methods for the task • Works in the implementation of regulations and safety regulations

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

• Knows dependence measuring sizes of the environment (temperature, pressure, cleanliness, humidity, etc.) • understands the importance of accuracy and thoroughness in measuring and calculating • Has knowledge of safety rules and regulations	• Processes the results in tables, performs calculations, shows the graphical dependence • Comparing with the chemically pure substances the Ergebnissemit the values in the tables • Analyze the problem, possible solutions developed using expertise and decides how the values are to be checked with alternative equipment • Reflects whether the problem is actually solved	

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Phase of the learning process	Content of work tasks	Organizational form of teaching (methodology)	Required Documents / Learning Supporting resources
1. Determination of kinematic viscosity using the Ubbelohde capillary viscometer			
Orientation, theoretical considerations	• Density determination and their calculation • Determination and calculation of dynamic and kinematic viscosity	Motivation Teachers lecture, class discussion	Instructions for the trainer / teacher panel Stream-sheet-video Powerpoint presentation E-Learning
Action, practical implementation **Time: 1,5 lessons**	<u>Determining the physical properties of liquids:</u> • Density determination using the pycnometer • Determination of the viscosity using the capillary viscometer Ubbelohde	demonstration Practical work	Instructions for the trainer / teacher Instructions for students
Monitoring and evaluation of action and results **Time: 0.5 lessons**	• Recording of all measured values in tabular form • Performing the calculations for density and viscosity • Graphical representation of dynamic viscosity as a function of temperature • Evaluation of the potential impact of temperature on the dynamic viscosity • Assessment of analyzed samples	3. Practical controls: 3.1 Work Result 3.2 Product Review	Instructions for the trainer / teacher literature Computer program Excel)

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Phase of the learning process	Content of work tasks	Organizational form of teaching (methodology)	Required Documents / Learning Supporting resources
2. Measurement of the molar refraction of the fluids for determining the quality of the raw material Imagine that you work in the quality department of the company Synthon and there will daily determination of the molar refraction of liquids transferred in the raw material. This test is very important for the proper determination of the purity and quality of the raw material.			
Orientation, theoretical considerations	• determination of the mol refraction	Motivation Teachers lecture, class discussion	Instructions for the trainer / teacher panel Stream-sheet-video Powerpoint presentation E-Learning
Action, practical implementation **Time: 1,5 lessons**	<u>Determination of the mol refraction of solvents for quality control of rubber:</u> • determination of the density and the refractive index	demonstration Practical work	Instructions for the trainer / teacher Instructions for students
Monitoring and evaluation of action and results **Time: 0.5 lessons**	• Recording of all measured values in tabular form • Calculating the density • Calculating the mol refraction by means of the Lorentz of Lorenz formula for the solvent used • Calculation of the molecular refraction and compared with the measured values • Comparison of Molrefraktionen with the values from the literature	3. Practical controls: 3.1 Work Result 3.2 Product Review	Instructions for the trainer / teacher literature Computer program Excel)

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Phase of the learning process	**Content of work tasks**	**Organizational form of teaching (methodology)**	**Required Documents / Learning Supporting resources**
3. Determination of the pH dependence of the biopharmaceutical drug of the concentration			
Orientation, theoretical considerations	• Determination of the pH-value	Motivation Teachers lecture, class discussion	Instructions for the trainer / teacher panel Stream-sheet-video Powerpoint presentation E-Learning
Action, practical implementation **Time: 1,5 lessons**	<u>Determination of the pH value as a quality indicator for the production of pharmaceutical substances:</u> • Determining the pH of solutions as a quality indicator for the production of pharmaceutical substances	demonstration Practical work	Instructions for the trainer / teacher Instructions for students
Monitoring and evaluation of action and results **Time: 0.5 lessons**	• Recording of all measured values in tabular form • Represent the pH in function of the concentration and the logarithm of the concentration in a diagram (drawing a calibration line) • Graphical analysis of the samples measured with the aid of the diagram (concentration determination) • Comparing the measured values with those calculated	3. Practical controls: 3.1 Work Result 3.2 Product Review	Instructions for the trainer / teacher literature Computer program Excel)

With the support of the Lifelong Learning Programme of the European Union.
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.