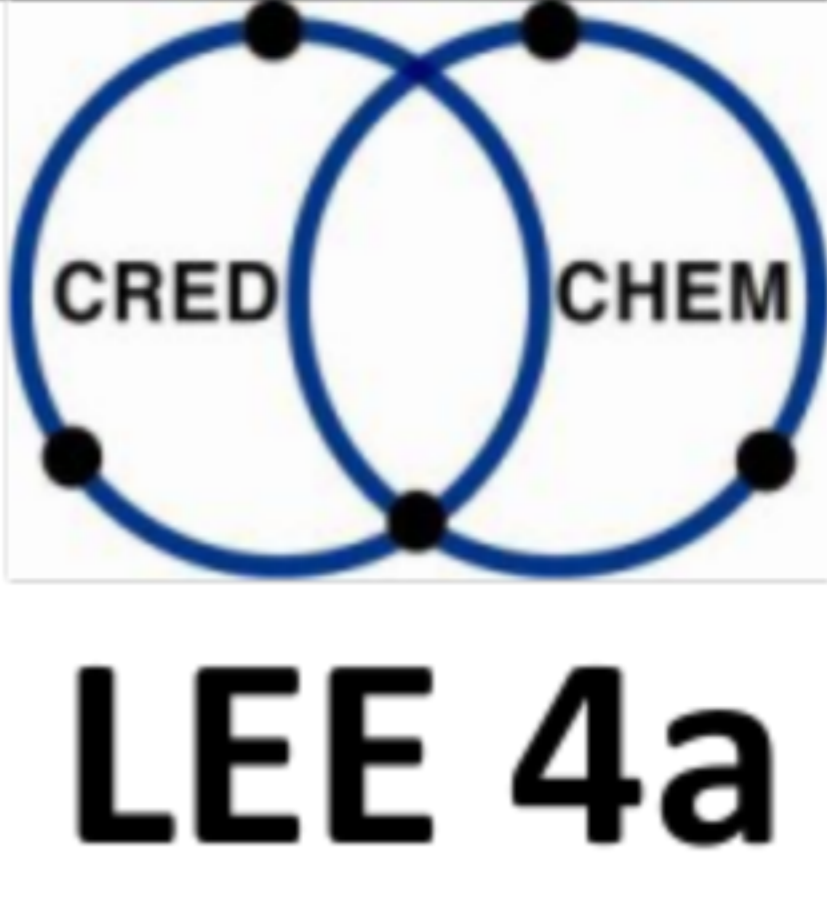
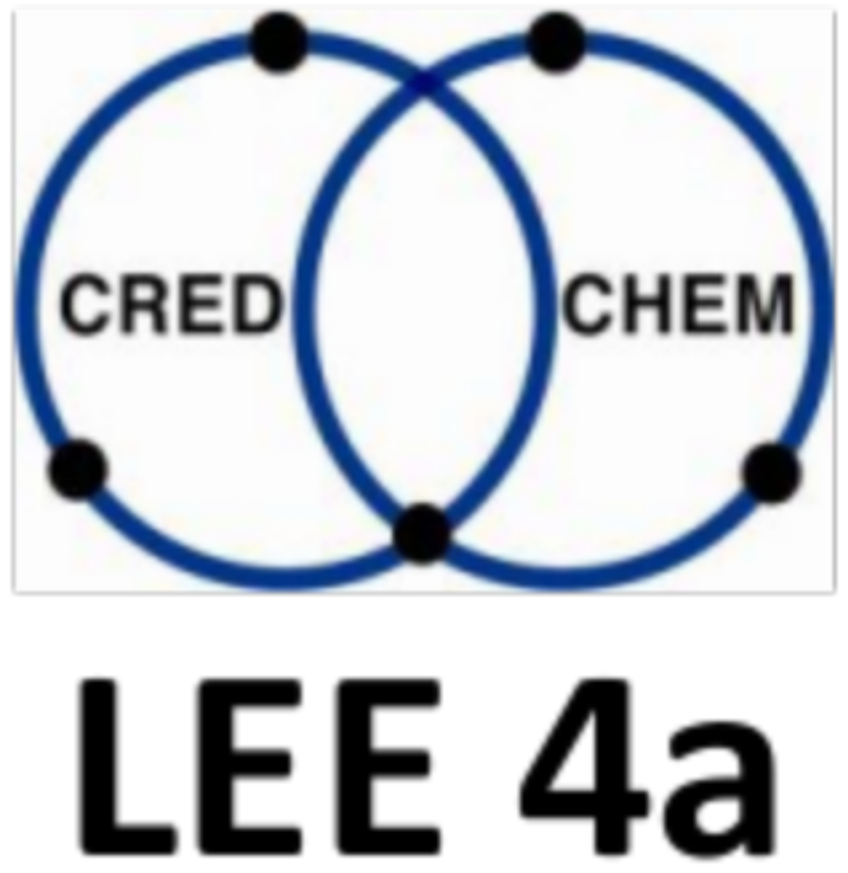


Field of action	Working in the laboratory				
Learning outcome unit	4a - Volumetric analysis of substances				
EQF level	Competence level A: EQF level 3 Competence level B: EQF level 4 Competence level C: EQF level 5				
Relations to national qualifications	BG	CZ	DE	IT	SK
	Chemist-operator, technology-technologist, laboratory technician, chemical laboratory technician	Chemical technician, chemical laboratory technician	Chemical laboratory technician	Biochemical technician	Chemical technician, chemical laboratory technician, chemical technology modeller
Learning outcomes					
Competence¹		Skills		Knowledge	
Competence level A (EQF level 3) - analyses substances volumetrically by using the standard methods and adapts these methods to the given conditions		- accepts orders for volumetric analysis of substances and plans all further processing steps until supplying the result - selects methods, respective laboratory equipment and necessary chemicals (solvents...) depending on the property/structure of the substances and handles them accurately, carefully and expertly - evaluates results and calculates respective values - prepares and evaluates the analysis expertly		- knows substances (properties, structure, R/S statements) - knows relationship between measurand and determinant and respective methods (knows steps of action) - knows respective equipment/ apparatuses and their functioning/ operation	
Competence level B: (EQF level 4) - deals with problems typical for the methods		- analyses the problem, develops solution approaches by applying specialist knowledge and decides how to solve the problem - reflects on whether the problem was actually solved		- knows dependence of values to be measured on environment conditions - knows reactions which the methods are based on - knows structural characteristics of a material which are responsible for its properties	
Competence level C: (EQF level 5) - optimises methods according to context in cooperation with the team		- works as part of the team, is actively involved in the work process and thus brings the work process forward - communicates with others about scientific and technological content (application of specialist knowledge) and about the work process		- knows relationship between measurand and determinant - knows relationship between the fundamental chemical principle (neutralisation/ precipitation...) and the practical use of titration	

¹ The competence levels build upon each other.

Field of action	Working in the laboratory					
Learning outcome unit	4a - Volumetric analysis of substances					
Countries	BG	CZ	DE	IT	SK	
Which CREDCHEM learning place offers the learning outcome unit?	Technical School for Chemical and Biotechnology Sofia	Technical School Valasske Mezirici, Technical School Usti n. Labem	Saxon Education Company for Environmental Protection and Chemical Occupations Dresden Ltd.	ITAS Scalcerle	Secondary Technical School Novaky, Secondary Technical School Bratislava	
How many learners can be admitted?	8	3	3-4	12	10	
At which competence level is the learning outcome unit offered?	A, B	A, B	A	A, B	A, B, C	
In which language is the mobility taught?	Bulgarian	English	German	English	English/German	
Which methods are used?	Potentiometric titration Conductometric titration Acid-base titration Complexometric titration Permanganometric titration Redox titration					
The following occupational tasks² (which can also be used for imparting the learning outcomes) have been exemplarily analysed in preparing the LEE:						
Redox titration of copper ions						
Complexometric titration of calcium ions						
Permanganometric titration of iron ions						
Permanganometric titration of calcium ions						
Permanganometric titration of Mohr's Salt						
Acid-base titration of acetic acid						
Acid-base titration of strong acids						
Acid-base titration of standard solutions						
Argentometric determination of chlorine ions						

² Occupational and examination tasks can be downloaded at www.credchem.eu.

Potentiometric titration of vinegar	
Potentiometric titration of lemonades	
Acid-base titration of ibuprofen	
Acid-base titration of tartaric acid	
Determination of acid neutralization capability	
Complexometric titration of zinc ions	
The following examination tasks were designed for the competence levels indicated:	<i>Competence level</i>
Argentometric determination of chlorine ions	A, B
Determination of acid neutralization capability	A, B, C
Acid-base titration of acetic acid	A, B
Conductometric determination of ammonium chloride	A, B
Acid-base titration of hydrochloric acid	A, B
Complexometric titration of zinc ions	A, B, C
Potentiometric titration of vinegar	A, B, C