



Schmidt-Schule

Jerusalem

Schulcurriculum
Chemie
Klassenstufe 9 – 10

Stand Februar 2013



The curriculum at hand is based on the "Lehrplan des Landes Thüringen."¹

Chemistry in Schmidt-Schule

The subject chemistry in Schmidt-Schule is taught in the English language starting from grade 7. The books used are "Complete Chemistry"², "A New Certificate Chemistry"³ and "GCSE Chemistry Complete Revision & Practise"⁴.

Further material is given by the teacher to especially differentiate according to the individual level of the student. The learning process is followed by the teacher with written and oral diagnosis depending on the circumstances. The reflection on the learning process will be done furthermore by the students.

Syllabus aims and objectives

A: Knowledge with understanding

Students should be able to demonstrate knowledge and understanding in relation to:

- Scientific phenomena, facts, laws, definitions, concepts and theories.
- Scientific vocabulary, terminology and conventions (including symbols, quantities and units).
- Scientific instruments and apparatus, including techniques of operation and aspects of safety.
- Scientific quantities and their determination.
- Scientific and technological applications with their social, economic and environmental implications.

B: Handling information and problem solving

Students should be able, in words or using other written forms of presentation (i.e. symbolic, graphical and numerical), to:

- Locate, select, organise and present information from a variety of sources.
- Translate information from one form to another.
- Manipulate numerical and other data.
- Use information to identify patterns, report trends and draw inferences.
- Present reasoned explanations for phenomena, patterns and relationships.

¹ Thüringer Ministerium für Bildung, Wissenschaft und Kultur (2012): Lehrplan für den Erwerb der allgemeinen Hochschulreife, Chemie.

² Gallagher, R.; Ingram, P. (): *Complete Chemistry*. Oxford: Oxford University Press.

³ Holderness, A. and others (1986): *A New Certificate*. London: Heinemann Educational Books.

⁴ Parsons, R.; Shepperson, A.: *GCSE Chemistry Complete Revision & Practise*. Cambridge: Coordination Group Publications Limited.



- Make predictions and hypotheses.
- Solve problems, including some of a quantitative nature.

C: Experimental skills and investigations

Students should be able to:

- Know how to use techniques, apparatus and materials (including following a sequences of instructions where appropriate).
- Make and record observations, measurements and estimates.
- Interpret and evaluate experimental observations and data.
- Plan investigations, evaluate methods and suggest possible improvements (including the selection of techniques, apparatus and materials).



Schulcurriculum

Fach	Chemie
Klassenstufe/Lehrwerk	9 und 10 (Complete Chemistry)

Kompetenzen	Inhalte/ Verweis auf Lehrwerk	Methodenkompetenz	Sonstiges (→ fächerverbindender Unterricht)	Operatoren
DIAGNOSE / TESTUNG				
1. Grade 9: Chemical Change ("Complete Chemistry", Unit 6)				
Students are able to: <ul style="list-style-type: none"> Differentiate between different kinds of chemical changes . Redox (oxidation reduction)reaction . 	OXIDATION - definition and examples: <ul style="list-style-type: none"> The gain or addition of oxygen by an atom, molecule or ion e.g. ... $S + O_2 \implies SO_2$ The loss or removal of electrons from an atom, ion or molecule e.g. $Fe \implies Fe^{2+} + 2e^-$ [iron atom loses 2 electrons to form the iron(II) ion] 	<ul style="list-style-type: none"> analysing of chemical reactions 	Science museum; oxidation, reduction reaction.	Define Calculate Identify



<ul style="list-style-type: none"> • Rusting as an oxidation reduction reaction • Direct combination • Decomposition 	<p>REDUCTION - definition and examples</p> <ul style="list-style-type: none"> • The loss or removal of oxygen from a compound etc. e.g. • $\text{CuO} + \text{H}_2 \rightleftharpoons \text{Cu} + \text{H}_2\text{O}$ [loss of oxygen from copper(II) oxide shows it to be reduced to copper atoms] • The gain or addition of electrons by an atom, ion or molecule e.g. • $\text{Cu}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}$ [the copper(II) ion gains 2 electrons to form neutral copper atoms e.g. in electrolysis or metal displacement reactions) • long term experiment: nail in water <p>A chemical change in which two substances react to give one single new substance .</p> <p>A chemical change in which one compound is decomposed into simpler substances by heating or electricity or enzyme.</p>	<ul style="list-style-type: none"> • student's presentation • Experiment Thermal decomposition: $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ Report. 	<p>Group work about photography.</p>	<p>Distinguish Describe</p>
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<ul style="list-style-type: none"> • Simple displacement: 	<ul style="list-style-type: none"> • Light can cause decomposition e.g. in photography is a sort of photo-decomposition. • silver chloride + light ==> silver + chlorine • $2\text{AgCl} \Rightarrow 2\text{Ag} + \text{Cl}_2$ • Thermal decomposition means to break down substances into two or more substances by heat. The decomposition of calcium carbonate (limestone) into calcium oxide (lime) and carbon dioxide in a high temperature lime kiln. <p>A chemical change in which the more reactive element displaces the lower one from salts (displacement of metals and non-metals according to the reactivity series)</p> <ul style="list-style-type: none"> • Place in order of reactivity: potassium, sodium, calcium, magnesium, zinc, (hydrogen) and copper, by reference to the reactions, 	<p>Experiment of reactivity: $\text{Cu} + \text{dilute HCl} \Rightarrow \text{no reaction}$ $\text{Zn} + \text{dilute HCl} \Rightarrow \text{ZnCl}_2 + \text{H}_2$</p> <p>report</p>		<p>Place in order Deduce Describe</p>
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<ul style="list-style-type: none"> Complex equations: reaction of Copper with concentrated nitric acid to produce nitrogen dioxide and reaction of copper with concentrated sulphuric acid to produce sulphur dioxide. 				
<ul style="list-style-type: none"> Neutralization reaction: 	<ul style="list-style-type: none"> Neutralization usually involves mixing an acid (pH <7 if soluble) with a base or alkali (pH > 7 if soluble) which react to form a neutral salt solution of around pH7 	Experiment $Mg + HCl \rightarrow MgCl_2 + H_2$ $NaOH + HCl \rightarrow NaCl + H_2O$ Make a research about neutralisation reactions in our daily life	student's presentation about salt in the Dead Sea	Describe Test Define
<ul style="list-style-type: none"> Precipitation reaction: 	<ul style="list-style-type: none"> Describe the preparation of insoluble salts by precipitation. Suggest a method of making a given salt from suitable starting material, given appropriate information The silver halide salts are used in photography and can be made by precipitation on mixing solutions of two soluble salts e.g. 	<ul style="list-style-type: none"> Experiment: $CuCO_3 + HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$ Report $AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO_3(aq)$ Tests for transition metals such as copper, Iron(II) and Iron (III) hydroxide report 		Describe Suggest Identify
<ul style="list-style-type: none"> Hydration reaction 	<ul style="list-style-type: none"> means the addition of water or combining with water. 	<ul style="list-style-type: none"> Experiment: $CuSO_4 \cdot 5H_2O(s) \xrightarrow{\text{heat}} CuSO_4(s) + 5H_2O(g)$ 		State Name



	<ul style="list-style-type: none"> On heating the blue solid, hydrated copper (II) sulphate, steam is given off and the white solid of anhydrous copper (II) sulphate is formed (left to right reaction is a dehydration, water lost). 	$5\text{H}_2\text{O}_{(g)}$ Report		
<ul style="list-style-type: none"> Dehydration reaction 	<ul style="list-style-type: none"> Means the losing or removal of water (see above). 	<ul style="list-style-type: none"> Experiment: $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}_{(s)} \rightleftharpoons \text{CuSO}_4_{(s)} + 5\text{H}_2\text{O}_{(g)}$ 		State Name
2. Rate of reaction ("Complete Chemistry" Unit 8)				
Students are able to: <ul style="list-style-type: none"> Describe the effect of concentration, particle size, catalysts (including enzymes) and temperature on the rate (speed) of reactions. Describe a practical method for investigating the rate (speed) of a reaction involving gas evolution. 	Supplement <ul style="list-style-type: none"> Devise a suitable method for investigating the effect of a given variable on the rate (speed) of a reaction. Interpret data obtained from experiments concerned with rate (speed) of reaction. Describe and explain the effects of temperature and concentration in terms of collisions between reacting particles. Describe the role of light 	<ul style="list-style-type: none"> Presentation about enzymes as catalyst . 	Experiments : Effect of catalyst on the decomposition of Hydrogen peroxide . Reaction between calcium carbonate with hydrochloric acid to find the effect of surface area.	Describe Interpret Devise



<ul style="list-style-type: none"> Describe the application of the above factors to the danger of explosive combustion with fine powders (e.g. flour mills) and gases (e.g. mines). <p>Note: Candidates should be encouraged to use the term rate rather than speed.</p>	<p>in photochemical reactions and the effect of light on the rate (speed) of these reactions.</p> <ul style="list-style-type: none"> Describe the use of silver salts in photography as a process of reduction of silver ions to silver; and photosynthesis as the reaction between carbon dioxide and water in the presence of chlorophyll and sunlight (energy) to produce glucose and oxygen. 			
<p>3. Acids and bases ("Complete Chemistry" Unit 9)</p>				
<ul style="list-style-type: none"> Students are able to: Define acids according to Arrhenius and their behaviour in aqueous solutions 	<ul style="list-style-type: none"> Names of the hydrochloric acids and their reaction in water, and their detection with indicators 	<ul style="list-style-type: none"> Experiment to find PH of things brought from home e.g.milk, tea, vinegar, lemon juice and salt. 	<ul style="list-style-type: none"> Student's presentation about Dead Sea salts. field trip to the salt factory in the Dead Sea 	<p>Define Name Differentiate Experiment</p>
<ul style="list-style-type: none"> Definition of Bases according to RHENIUS and their behavior in aqueous solutions. 	<ul style="list-style-type: none"> Sodium hydroxide and potassium hydroxide as a solid, and as bases in water and their detection with indicators (litmus and phenolphthalein) 		<ul style="list-style-type: none"> Science museum Acids , alkalis indicators (home made and chemicals 	
<ul style="list-style-type: none"> Neutralisation 	<ul style="list-style-type: none"> Neutralization of Hydrochloric acid and Sodium Hydroxide – 	<ul style="list-style-type: none"> Quantitative titration will not be done. 	<ul style="list-style-type: none"> Student's presentation about uses of neutralisation in daily 	



	qualitative and quantitative Titration.		life.	
<ul style="list-style-type: none"> Production principle and name of the oxygenated acids and their salts (name) 	<ul style="list-style-type: none"> Nonmetal oxides give in water oxygen containing acid; carbonic acids and carbonates, sulfates und sulfuric acid, phosphoric acid and phosphates. 		<ul style="list-style-type: none"> Student presentation about alkaline Diet. 	
<ul style="list-style-type: none"> Know the Brönstedt Definition of acid and Base and understand it as Protolysis (proton migration) . 	<ul style="list-style-type: none"> Acids as proton donors, basas as proton acceptor, acid-base pairs, acid with multiple Protons with stepwise proton release. 			
<ul style="list-style-type: none"> Know the autoprotolysis of water and the definition of pH values and determination these for acids and salts. 	<ul style="list-style-type: none"> Autoprotolysis of water as balance reaction and ion product with pH and pOH with the pH scale. 			

1. Grade 10: Energy Changes in Reactions ("Complete Chemistry" Unit 8)

<p>Students are able to :</p> <ul style="list-style-type: none"> Interpret simple energy level diagrams. Compare between two different fuels. Calculate ΔH. Calculate bond energies 	<ul style="list-style-type: none"> Describe bond breaking as endothermic and bond forming as exothermic. including the idea of activation energy and the effect of this on catalysts Describe the production of heat energy by burning fuels. 	<ul style="list-style-type: none"> Group work calculations 	<ul style="list-style-type: none"> Presentation about types of fuel. 	<p>Differentiate Measure Compare Analyse</p>
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	<ul style="list-style-type: none"> Knowing the amount of energy involved in chemical reactions is useful so that resources are used efficiently and economically. It is possible to measure the amount of energy experimentally or to calculate it 			
2. Non-metals: Hydrogen and Nitrogen ("Complete Chemistry" Unit 13 and 14)				
<p>Student should</p> <ul style="list-style-type: none"> prepare a sample of hydrogen and test for it . Describe its properties 	<ul style="list-style-type: none"> Uses of Hydrogen Describe hydrogen as a fuel Chemical and physical properties of Hydrogen how they are collected: upward delivery or downward delivery Laboratory preparation of Hydrogen prepare a sample of dry Hydrogen. 	<ul style="list-style-type: none"> Experiment $Zn + HCl \rightarrow ZnCl_2 + H_2$ Testing for hydrogen internet research on the uses of hydrogen as the possible future fuel 		<p>Name</p> <p>Describe</p> <p>State</p> <p>Test</p>
<p>Students are able to:</p> <ul style="list-style-type: none"> Describe and explain the presence of nitrogen and its compounds Prepare Ammonia Explain the haber process 	<ul style="list-style-type: none"> Properties of Nitrogen Oxides of Nitrogen Chemical and physical properties of Ammonia Reactions with Nitric acid Uses of Nitric acid Nitrates : salts of Nitric acid 	<ul style="list-style-type: none"> Experiment : preparation of Ammonia $2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + 2H_2O + CaCl_2$ Test for Ammonia (report) 	<ul style="list-style-type: none"> Visit to the science museum Presentation about fertilisers . 	<p>Describe</p> <p>Prepare</p> <p>Test</p>



3. Non-metals: Oxygen, Sulphur and Carbon ("Complete Chemistry" Unit 15)

Students are able to : <ul style="list-style-type: none"> Differentiate between the different compounds of oxygen Prepare oxygen and test for it 	<ul style="list-style-type: none"> Percentage composition of air Chemical and physical properties of Oxygen Compounds of Oxygen such as oxides Classify oxides as acidic or basic, related to metallic and non-metallic character. Further classify other oxides as neutral or amphoteric Uses of Oxygen 	Experiment : preparation of Oxygen <ul style="list-style-type: none"> $\text{KClO}_3 \rightarrow \text{KCl} + 3\text{O}_2$ Test for Oxygen 	(Visit to the science museum, see up)	Prepare Test Classify
Students are able to : <ul style="list-style-type: none"> Explain the presence of Sulphur in nature. 	<ul style="list-style-type: none"> Chemical and physical properties of Sulphur Extraction of Sulphur from underground Compounds of sulphur such as sulphur dioxide and sulphuric acid: Preparation of sulphur dioxide Chemical and physical properties of sulphur dioxide Uses of sulphur dioxide Test for sulphur dioxide 	<ul style="list-style-type: none"> Internet research of the uses of sulphuric acid in in the house. Project about acid rain 		Name State Prepare Describe
Students are able to : <ul style="list-style-type: none"> Describe the formation of carbon dioxide State that carbon dioxide and methane are greenhouse gases 	<ul style="list-style-type: none"> Allotropy: existence of the same element in different shapes such as diamond and graphite Difference between diamond and graphite. 	<ul style="list-style-type: none"> Experiment: Preparation of Carbon dioxide $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$	→ Project Blue Planet with B, E, D-Z, Social Science	Differentiate Test Describe



<p>and may contribute to climate change.</p> <ul style="list-style-type: none"> • Explain the causes and consequences of the increase of carbon dioxide concentration in the atmosphere. 	<ul style="list-style-type: none"> • Carbon dioxide: its chemical and physical properties • Uses of carbon dioxide • Test for carbon dioxide • Describe the carbon cycle • Carbon monoxide form the incomplete combustion of carbon – containing substances • Carbon dioxide: As a product of complete combustion of carbon – containing substances. 	<ul style="list-style-type: none"> • Test for carbon dioxide 	<ul style="list-style-type: none"> • Differentiate between diamond and graphite 	
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4. Natural gas and petroleum ("Complete Chemistry" Unit 16)

<p>Students are able to:</p> <ul style="list-style-type: none"> • Identify natural gases , petroleum and carbon as fossil energy agent . • Apply the knowledge of the mixture of substances and substance separation on the example of fractional distillation of petroleum . • Demonstrate the combustion products of 	<ul style="list-style-type: none"> • Plastic is one of the many materials made from crude oil . • Plastic is made by polymerisation starting from monomer . • The daily use of plastics in our life such as ;plastic bottles , dustbins ,cling film and credit cards . 	<ul style="list-style-type: none"> • Internet research about recycling of plastics . • Make a small project about collecting recyclable materials . 	<p>Experiment :</p> <ul style="list-style-type: none"> • Study the effect of heat on both polythene and melamine. • Make a report . • Group work about presentation of uses of plastics . 	<p>Identify</p> <p>Apply</p> <p>Demonstrate</p> <p>Explain</p> <p>Name</p> <p>Describe</p>
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<p>burning water and carbom dioxide .</p> <ul style="list-style-type: none"> • Explain the relationship of saturated carbon molecules with the help of van-der-Waals energies . • Name saturated carbons from simple to complex ones • Describe the polymerization of ethylene and propylene 				
5. Alcohols and carboxylic acids ("Complete Chemistry" Unit 17)				
<p>Students are able to:</p> <ul style="list-style-type: none"> • Describe the structure , characteristics and production of ethanol . • Distinguish the hydroxyl groups as functional groups • Explain the hydrogen bonding in ethanol molecules • Assess the effect of ethanol 	<p>Ethanol contain the OH group :</p> <ul style="list-style-type: none"> • Ethanol is a good solvent . it dissolves many compounds that are insoluble in water. • It evaporates easily that's why it is used in printing inks ,deodorants ,and aftershave. 	<p>Internet research:</p> <ul style="list-style-type: none"> • about abusing alcohol • The effect of alcohol socially • How ethanol is made by fermentation • Vegetable oils are mixtures of natural esters 	<p>Experiment :</p> <ul style="list-style-type: none"> • Compare the ethanol solution and the Natrium hydroxide solution • Examine the combustion and dissolubility of ethanol • Test how it is miscible with water 	<p>Describe Distinguish Explain Assess Name Compare Make</p>



<p>as an acceptable social drug</p> <ul style="list-style-type: none">• Name the importance and use of other alcohols• Identify the carboxylic acids as functional groups• Describe the production of ethanoic acid• Compare between ethanoic acid and sodium ethanoate salt• Describe the reaction of alcohol with carboxylic acids to form Esters	<ul style="list-style-type: none">• Esters are used as solvents, in food flavourings , and as fragrances in beauty products Like shampoo• Carboxylic acids contain the functional group -COOH	<ul style="list-style-type: none">• How soap is made from oil and sodium hydroxide	<ul style="list-style-type: none">• Make a soap from olive oil and sodium hydroxide• Produce a fruit ester	
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