Diploma Programme subject outline–Group 4: sciences			
School name	Gymnázium a Střední odborná škola Rokycany	**School code**	
Name of the DP subject *(indicate language)*	Chemistry HL		
Level *(indicate with X)*	Higher [x] Standard completed in two years [ ] Standard completed in one year * [ ]		
Name of the teacher who completed this outline	Vladimíra Moulisová, Kravec Petr	**Date of IB training**	*3 - 5 May 2024*
Date when outline was completed		**Name of workshop** *(indicate name of subject and workshop category)*	*InThinking* workshop **DP Chemistry, cat 2,** Stockholm

* All Diploma Programme courses are designed as two-year learning experiences. However, up to two standard level subjects, excluding languages ab initio and pilot subjects, can be completed in one year, according to conditions established in the *Handbook of procedures for the Diploma Programme*.

1. Course outline

- Use the following table to organize the topics to be taught in the course. If you need to include topics that cover other requirements you have to teach (for example, national syllabus), make sure that you do so in an integrated way, but also differentiate them using italics. Add as many rows as you need.
- This document should not be a day-by-day accounting of each unit. It is an outline showing how you will distribute the topics and the time to ensure that students are prepared to comply with the requirements of the subject.
- This outline should show how you will develop the teaching of the subject. It should reflect the individual nature of the course in your classroom and should not just be a “copy and paste” from the subject guide.
- If you will teach both higher and standard level, make sure that this is clearly identified in your outline.

	Topic/unit (as identified in the IB subject guide) *State the topics/units in the order you are planning to teach them.*	Contents	Allocated time One class is 45 minutes. In one week there are 5 classes.	Assessment instruments to be used	Resources *List the main resources to be used, including information technology if applicable.*
Year 1	**Structure 1. Models of the particulate nature of matter**	S1.2 The nuclear atom S1.2 The nuclear atom S1.3 Electron configuration S1.4 Counting particles by mass: The mole S1.5. Ideal gases	28 classes **21 hours** 11 classes in Lab **8 hours**	Assessment instruments to be used Written and online unit tests with summative and formative assessment and peer-review Smaller test in Moodle,G-forms, Socrative Rubric-based assessment of some practical lessons Assessment with some of IA criteria for some practical lessons Assessment of Group work participation, homework, activity	Chemistry Guide 2023 International Baccalaureate Organization CHEMISTRY 2023 – Course companion, S. Bylikin et al., Oxford University Press IB Study Guide: Chemistry 2023 Edition, Oxford University Press Organic Chemistry, J. McMurry 2010, Brooks/Cole IB Chemistry Revision Notes High level, V. Keat, Independently published IB Chemistry Revision Notes Standart level, V. Keat, Independently published Chemistry An Introduction to General, Organic and Biological Chemistry, K. Timberlake, Pearson
	Structure 2. Models of bonding and structure	S2.1 The ionic model S.2.2 The covalent model S2.3 The metallic model S.2.4 From models to materials	27 classes **30 hours** 8 classes in Lab **6 hours**		
	Structure 3. Classification of matter	S3.1. The periodic table: Classification of elements S3.2. Functional groups: Classification of organic compounds	41 classes **31 hours** 7 classes in Lab **5 hours**		
	Reactivity 1. What drives chemical reactions?	R1.1 Measuring enthalpy changes R1.2 Energy cycles in reaction R1.3 Energy from fuels R1.4 Entropy and spontaneity	29 classes **22 hours** 9 classes in Lab **7 hours**		

Year 2	**Reactivity 2. How much, how fast and how far?**	R2.1 How much? The amount of chemical change R2.2 How fast? The rate of chemical change R2.3 How far? The extent of chemical change	41 classes **31 hours** 6 classes in Lab **4 hours**	during lessons Formative assessment oral and by using online tools Socrative, Plickers, Mentimeter	Education Limited Online resources (Youtube – e.g. TeDeD, My IB communities, PhET interactive simulations, khanacademy.org) Online or open source software tools and databases (protein databases such as https://www.rcsb.org/
	Reactivity 3. What are the mechanisms of chemical change	R3.1 Proton transfer reactions R3.2 Electron transfer reactions R3.3 Electron sharing reactions R3.4 Electron pair sharing reactions	60 classes **45 hours** 13 classes in Lab **10 hours**		

2. Collaborative sciences project (CSP)

As the IB guides say, "The collaborative sciences project is an interdisciplinary sciences project, providing a worthwhile challenge to DP students, addressing real-world problems that can be explored through the sciences. The nature of the challenge should allow students to integrate factual, procedural and conceptual knowledge developed through the study of their disciplines.'" Describe how you will organize this activity. Indicate the timeline and subjects involved, if applicable.

As the CSP should be done collaboratively among Subject Group 4 Science subjects, our students will go through a project concerning at minimum two of them: Biology and Chemistry, Biology and Physics or Chemistry and Physics. Students will develop especially their collaboration and communication skills.
Each working group of 3-4 participants will be asked to specify their project while discussing with lecturers. The groups will work towards a common goal related to a real-world issue, pursued through the lens of the scientific method. Nevertheless, they should engage also with a local context.
The groups will spend 2,25 hours of planning, 4,5 hours of executing, 2 hours of finalizing their results and 1,75 hours of presenting to other groups and eventually other pupils (e.g. pre-IB cohort). While working on the projects, teachers will be available to discuss the findings and helpfully support all students.
The CSP will start in March and finish up in April of the first IB DP year as per internal IB calendar.
After the CSP is completed, students will write a 100-word reflection and submit to ManageBac.

3. IB practical work and the internal assessment requirement to be completed during the course

Internal assesment will be carried out during the first year and the beginnig of the second year.
Total time allocated is 14 lessons (**10,5 hours**).

- Teacher explains to students the requirements of the internal assessment.(2 lessons in September Year 1)
- Students are scaffolded by the teacher during labs in PSOW and think about the best topic for them (October-February Y1)
- Students discuss and decide their topics (1 lessons in February)
- Students read samples of IA, mark them and discuss them together. (2 – lessons March Y1)
- Students work on their IA component, ask questions and consultate it with the teacher (7 lessons April – June Y1)
- Students hand out their draft. (beginning of September Year 2)
- Teacher gives feedback to the drafts (2 lessons at the end of September Y2)
- Students hand out final version at the end of October Y2.
- Time allocation to each stage may differ according to the needs of students

Name of the topic	Experiment	Any ICT used? *Remember you must use all five within your programme.*
Acids and bases	Titration	Yes
S1.2. The nuclear atom	Radioactive radiation and Rutherford scattering	Computer modeling and simulations- PhET
S1.3. Electron configurations	Flame tests	No
S1.3. Electron configurations (HL)	Ionization energies	Databases, spreadsheets, graphs
S1.4. The mole concept	The determination of a chemical formula	No
S2.2. The covalent model	TLC of plant pigments	Databases

S2.2. The covalent model (HL)	VSEPR in action: Molecular geometries in 3D	Computer modeling and simulations, Databases
S3.2. Functional groups (HL)	Organic chemistry: 3D modeling of proteins	Computer modeling and simulations, Databases
S3.2. Functional groups	Constructions of 3D models a) real – Orbit molecular building system b) virtual – ChemSketch, online simulations c) Searching complex molecules	Computer modeling and simulations, Databases
R1.1. Measuring energy changes	Estimating enthalpy change for reaction of metal zinc with copper sulphate solution	Graph plotting
R1.1. Measuring energy changes (HL)	Thermometric titration of HCl solution	Graph plotting
R2.2. Chemical change: Rates of reaction	Rate of chemical reactions, dependence of reaction rate on concentration of substances	Datalogging, Spreadsheet, Graph plotting – MS Office
R2.2. Chemical change: Rates of reaction (HL)	Rate of chemical reactions, dependence of reaction rate on surface area of reactants	Datalogging, Spreadsheet, Graph plotting
R3.1. Proton transfer reactions	Acid-base titration: Acetylosalicylic acid content in Aspirin	Datalogging, spreadsheet, graphing – MS Office
R3.1. Proton transfer reactions	Measurement of pH - pH meter, universal indicator, natural indicator from red cabagge	Spreadsheet
R3.1. Electron transfer reactions	Redox titration: Assessment of iron (II) concentration in tablets by permanganate solution	
R3.1. Electron transfer reactions (HL)	Measuring standard cell potential for zinc and copper (II)	Datalogging, Spreadsheet, Graph plotting – MS Office

4. Laboratory facilities

Describe the laboratory and indicate whether it is presently equipped to facilitate the practical work that you have indicated in the chart above. If it is not, indicate the timeline to achieve this objective and describe the safety measures that are applicable.

Our laboratory was renovated a few years ago and it fulfils all the safety standards in the Czech Republic. There are 8 lab benches and a fume cupboard. Every lab bench offers a gas burner, an electric socket and a small sink. There are 4 large sinks for washing the laboratory glassware. Standard laboratory equipment such as glass ware is available at every bench. We have a range of different sensors (pH, temperature, O_2, CO_2…) and we would like to raise their number before the start of the first IB DP year in 2022 to have a sufficient number of them according to the estimated number of students.

We have a broad range of different chemicals and reagents, most of them are stored in a separate locked room. Some chemicals are stored in the laboratory in locked cabinets. Flammable and corrosive chemicals are placed separately in cabinets designed for this purpose. We will update the labels with appropriate hazard warning on most of the chemicals because they don't follow actual standards. We will also update the inventory of all laboratory chemicals. All will be done before the start of the first IB DP year in 2022.

Personal protective equipment is always available for both, students and staff (lab coats, goggles, gloves etc.), and is used whenever needed (using chemicals, working with strong acids and bases etc.). Students are familiarized with safety rules at the beginning of each year. The safety rules print out of is also placed on the laboratory doors.

Safety equipment includes a fire extinguisher, a fire blanket, an emergency shower, a first aid kit. All of them are available in the laboratory. We will install an eyewash station till the first IB DP year in 2022.

In general, the lab is very well equipped for standard high school labs (range of chemicals, standard apparatuses, chemical utensils). Recently we have a safety shower done which had been missing, and we have bought Vernier's lab sets that will be available for IB DP students. Our laboratory should fulfil all IB safety standards and will comply with EU legislation.

5. Other resources

Indicate what other resources the school has to support the implementation of the subject and what plans there are to improve them, if needed.

Our school's classrooms are all equipped with computers, multimedia projectors, touchboards, speakers, and high-speed Wi-Fi. There is a computer lab and a well-equipped library with several multimedia and VR stations accessible to students. The school has purchased teacher resource materials for every subject including textbooks, subject guides and teaching methodology material. There is also a virtual link to the library of Western Bohemia University in Pilsen which enables students and teachers to use a wide variety of resources, magazine articles, fiction and non-fiction literature, etc.

There are also printing and scanning stations available to students and teachers enabling them to work with and create various teaching and learning materials. Overall, the amount and quality of available resources is sufficient to give effective support to the Chemistry course.

6. Links to TOK

You are expected to explore links between the topics of your subject and TOK. As an example of how you would do this, choose one topic from your course outline that would allow your students to make links with TOK. Describe how you would plan the lesson.

Topic	Link with TOK (including description of lesson plan)
S1.1. Particulate nature of matter S1.4. The mole concept	The language of chemistry is universal for all chemists around the world. The symbols for elements, compounds are used all around the world, although the most of the countries use different names for elements, compounds, etc. Students will be asked to think about advantages and disadvantages which the universal chemical language brings. Students should think about why different countries use their own names for elements and whether it would be beneficial if the chemical language was universal also for names of elements, compounds, etc., discussing possible advantages and disadvantages for scientists, teachers, students, non-professional users. Students should present their ideas using English (worldwide used) as well as Czech or another national chemical language.

7. Approaches to learning

Every IB course should contribute to the development of students' approaches to learning skills. As an example of how you would do this, choose one topic from your outline that would allow your students to specifically develop one or more of these skill categories (thinking, communication, social, self-management or research).

Topic	Contribution to the development of students' approaches to learning skills (including one or more skill category)
R3.1. Proton transfer reactions	A practical lesson - Measurement of pH can serve as an example. Students will develop their communication, social and self-management skills because they will work in pairs during this lesson. They will need to discuss everything with their partner, plan the work, divide it and finish it in the time given. Students will use three different methods to measure pH of different solutions. After finishing their practical work, students will develop their critical thinking by evaluating the accuracy of each method and considering reasons for differences among them. In the end, students should decide which method (equipment) would be suitable for home use considering its accuracy, price and simplicity of the use. They will need to search for some necessary facts. Students can share ideas with other pairs and reflect others' ideas (peer review).

8. International mindedness

Every IB course should contribute to the development of international-mindedness in students. As an example of how you would do this, choose one topic from your outline that would allow your students to analyse it from different cultural perspectives. Briefly explain the reason for your choice and what resources you will use to achieve this goal.

Topic	Contribution to the development of international mindedness (including resources you will use)
R1.1. Measuring energy changes	CFCs (chlorofluorocarbons) damage the ozone layer and have been a big ecological topic for many years. Students divided into groups of 3-6 will explore and think about restrictions which influence use of CFCs in different parts of the world. Why are they still used in different countries and what other chemicals substitute or might substitute them in the future ? What are advantages and disadvantages of these substitutes? Groups will work separately using the Internet, present and discuss their ideas with the others at the end.

9. Development of the IB learner profile

Through the course it is also expected that students will develop the attributes of the IB learner profile. As an example of how you would do this, choose one topic from your course outline and explain how the contents and related skills would pursue the development of any attribute(s) of the IB learner profile that you will identify.

Topic	Contribution to the development of the attribute(s) of the IB learner profile
R3.1. Proton transfer reactions	A practical lesson - Measurement of pH can be again a good example, this time for developing the IB learner profile attributes. According to the description point 7 Approaches to learning, this activity develops these attributes: Communicator, open-minded – collaborative work with the partner, dealing with his/her ideas andneeds, sharing ideas among other groups Principled – dividing, planning and finishing the activity in time Knowledgeable – raising knowledge about different methods of pH measurements Thinker – critically thinking about the accuracy of the methods used and reasons for it, thinking about ideas and opinions of other pairs Reflective, thinker – considering different aspects for home use based on gained experience