Diploma Programme subject outline–Group 4: sciences			
School name	Haganässkolan	**School code**	051587
Name of the DP subject *(indicate language)*	Biology		
Level *(indicate with X)*	Higher X	Standard completed in two years X	Standard completed in one year *
Name of the teacher who completed this outline	Karin Ringblom	**Date of IB training**	June 2016 and June 2020
Date when outline was completed	2020-05-20	**Name of workshop** *(indicate name of subject and workshop category)*	Biology cat. 1 Biology cat. 2

* 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

	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 75 minutes. In one week there are 3 classes.	Assessment instruments to be used	Resources *List the main resources to be used, including information technology if applicable.*
Year 1	**SL - Cell biology (topic 1)**	**Structure and functions of cells, cell membranes and cell organelles. Cell division.**	**15h**	Students will be assessed on a regular basis, both formatively and summatively. Examples of this can be end of unit tests and lab rapports. Assessments will include examinations developed from previous IB examinations by the teacher. Classroom assessments will place emphasis on a criterion referenced rather than norm referenced assessment. This will ensure that students are aware of and practice the skills required for the external assessments. IB examination mark schemes and rubrics allow students and teachers to accurately reflect on student progress and what arias need improvement. Student self-assessment will be encouraged where appropriate.	Textbook Power point presentations Videos Equipped laboratory for practical work (including dataloggers) Online simulations Student computers
	SL - Molecular biology (topic 2) HL - Nucleic acids (topic 7) HL - Metabolism, cell respiration and photosynthesis (topic 8)	**Biological molecules (lipids, carbohydrates and proteins). Enzymes, DNA and RNA. Replication, transcription and translation.** Deeper understanding in DNA and RNA replication, transcription and translation **Cell respiration and photosynthesis.** Deeper understanding of metabolism, cell respiration and photosyntethis.	**21h** 9h 14h		
	SL - Genetics (topic 3) HL - Nucleic acids (topic 7) HL - Genetics and evolution (topic 10)	**Genes,** deeper understanding of gene expression, **chromosomes, meiosis,** deeper understanding of meiosis, **Inheritance,** gene pools and speciation**. Biotechnology and modification of genes.**	**15h** 8h		
	SL - Ecology (topic 4)	**Species, communities and ecosystems. Flow of energy through the ecosystem. Carbon cycle and climate change.**	**12h**		

Year 2	HL - Plant biology (topic 9)	Xylem and phloem transport in plants. Growth and reproduction in plants	13h		
	SL - Ecology and conservation (Option C) HL – Ecology and conservation (Option C)	**Species, communities and ecosystems.** Population ecology. **Human impact on ecosystems.** Nitrogen and phosphorus cycles. **Conservation of biodiversity.**	**15h** 10h		
	SL - Evolution and biodiversity (topic 5)	**Natural selection and evidence for evolution. Cladistics and classification of biodiversity.**	**12h**		
	SL - Human physiology (topic 6) HL - Animal physiology (topic 11)	**Digestion and absorption. The blood system and internal transport. Gas exchange. Neurons and synapses. Hormones, homeostasis and reproduction.** Deeper understanding of Sexual reproduction. **Immune system and infections.** Deeper understanding of immune system. Vaccination. Muscular movement. Osmoregulation and function of the kidney.	**20h** 16h		

2. The group 4 project

As the IB guides say, "The group 4 project is a collaborative activity where students from different group 4 subjects work together on a scientific or technological topic, allowing for concepts and perceptions from across the disciplines to be shared in line with aim 10—that is, to 'encourage an understanding of the relationships between scientific disciplines and the overarching nature of the scientific method.'" Describe how you will organize this activity. Indicate the timeline and subjects involved, if applicable.

Group 4 project is completed at the end of the students first year. It will involve biology, physics, chemistry and design technology. The overall topic will concern sustainable development and sustainable living.

1. Information in class and handouts to students a week in advance, for them to take home, read and think about before the first session of planning.
2. First meeting with all group 4 students (1h) for the students to share their ideas and decide on a topic (with input from teachers if necessary).
3. Second meeting (1h) for the students to plan their project and make a schedule for their work.
4. Depending on what project the students choose (and the teachers approve) the action stage will be scheduled accordingly (6h). Either in lessons during a week or a whole day will be set aside to work with the project.
5. A symposium is arranged for the student groups to present their projects (1,5h)
6. Evaluation meeting for the project groups to discuss and write down their reflexions (0,5h).

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

As you know, students should undergo practical work related to the syllabus.

- Physics, chemistry and biology: 40 hours (at standard level) or 60 hours (at higher level)
- Computer science: 40 hours (at standard level) or 40 hours (at higher level)
- Design technology: 60 hours (at standard level) or 96 hours (at higher level)
- Sport, exercise and health science: 40 hours (at standard level) or 60 hours (at higher level)

Use the table below to indicate the name of the experiment you would propose for the different topics in the syllabus.

An example is given. Add as many rows as necessary.

Name of the topic	Experiment	Any ICT used? *Remember you must use all five within your programme.* Datalogging, Spreadsheets, Graphing, Modeling & Simulations and Accessing Databases.	ATL Explicit teaching Where Applicable *(communication, social, self management-organization, self management-affective skills, self-management-reflection, research-info and media literacy, thinking-critical thinking, thinking-transfer thinking)*
Acids and bases	Titration	Yes	
SL - Cell biology (topic 1)	**Using microscopes to investigate stomata (P1)** Calculation of magnification and actual size of structures from micrographs Electron micrographs, identify organelles **Investigating the osmolarity of plant tissues (P2)**	Spreadsheets and graphing	Group work - *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills*
SL - Molecular biology (topic 2)	Molecule visualization software of cellulose, starch and glycogen. Denaturation of proteins **Investigating the activity of enzymes (P3)** **Investigating pigments present in plant leaves through chromatography (P4)**	Simulations Spreadsheets and graphing	Constructing own experiment – *Thinking skills* Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills* Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills*

HL - Nucleic acids (topic 7)	Using molecular visualization software to analyse the association of DNA/Histone in nucleosomes. Using molecular visualization software to analyse the the structure of tRNA and eukaryotic ribosomes.	Simulations Simulations	
HL - Metabolism, cell respiration and photosynthesis (topic 8)	Study the role of oxygen in yeast cell respiration. Limiting factors of photosynthesis.		
SL - Genetics (topic 3)	Predicted/actual outcomes of genetic crosses Analyzing microsopic slides of meiosis Genbank database for base sequence differences	Modeling and simulations Databases	
HL - Nucleic acids (topic 7)	Using molecular visualization software to analyze the association of DNA and histone in nucleosomes.	Simulations	
HL - Genetics and evolution (topic 10)	Construct a cladogram using the sequence for Cytokrom C for a group of organisms.	Databases	
SL - Ecology (topic 4)	**Observing a sustainable ecosystem using a mesocosm (P5)** Counting frames Fieldtrip to local lake to conduct a study of water quality and status of lake environs. **Using a potometer to investigate transpiration (p7)**	Spreadsheets and graphing Datalogging	Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills* Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills*
HL - Plant biology (topic 9)	Xylem, phloem, stem, root histology. Design an experiment to test a hypotheses about the effect of temperature or humidity on transpiration rates.	Datalogging, spreadsheets and graphing	Constructing own experiment – *Thinking skills* Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills*
SL - Evolution and biodiversity (topic 5)	Simulation of natural selection Classification of several species Construct a dichotomous key Analysis of cladograms to deduce evolutionary relationships.	Simulation Databases	

SL - Ecology and conservation (Option C)	Investigate the effect of an environmental disturbance on an ecosystem. Capture – mark – release Nutrient content of soil samples.	Simulation	
HL – Ecology and conservation (Option C)			
SL - Human physiology (topic 6)	Identification of tissue layers in transverse sections of small intestine microscope slides. Blood vessel identification from microscopic slides **Exploring ventilation rates (P6)** Meassure reaction time	Datalogging, spreadsheet and graphing	Group work – *Social skills* Written lab report – *Communication skills, self management skills, research skills and thinking skills*
HL - Animal physiology (topic 11)	Measurement of sarcomere from microscope slides. Penicillin resistance in bacteria. Comparison of fetus development in some vertebrates.	Simulations	

1. IB internal assessment requirement to be completed during the course

Briefly explain how and when you will work on it. Include the date when you will first introduce the internal assessment requirement to your students, the different stages and when the internal assessment requirement will be due.

Date IA is introduced : 3 of June year one Date IA draft for comments due : 31 of January year two Date final IA is due : 31 of March year two
Date EA requirements introduced : Beginning of January in year two Date students will be prepared to complete EAs : Course content gone though by the 14th of February. The remaining weeks until EA spent practising old exam questions and discussing how to best answer them. Custemized work for all students based on the results from their mock exams.

Brief explanation how you work with IA and EA :Students trained in scientific report writing all through the course since all required practicals include a written lab report. All reports based on IA format and graded the same way. This will let students practise before the start of the IA process. IA intruduced at end of year one. Discussions about how to tackle the IA, requirements and grades. Practical work encouraged. First draft for IA handed in at end of January. Comments on drafts before the end of February. Final version of IA to be sent in at the end of March. Information abour EA continuously through the two year program, a few old exam questions at the end of each topic, students to work in small groups with answers followed by discussion about the answers to give all students formative training in what makes a good quality answer. Content knowlage also tested with a ordenary test at the end of each topic. Also for EA se above.

2. 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.

There are two laboratories available for lessons in biology. One (the chemistry lab) is equipped with seven work places with sinks and fume cupboards, suitable for individual work or up to seven student groups of two to three students in each. The other (biology lab) have four sinks and eight large workbenches, suitable for individual work or up to eight student groups with two to three student in each. Both labs have safety shower, emergency eye-wash fountain, fire blanket and fire extinguisher. Labs equipped with everything necessary to preform all practical work listed above.

3. 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.

The school have a large swimmingpool, a gym and two gymnasiums that can all be used for studying how different physical activities affect the body. The school is situated within easy reach of different natural habitats (natural forests, cultivated forests, pastures, farmed land, lakes and rivers) and some industries (including peat harvesting and aluminum smelting and casting) suitable for studies of unaffected habitats and how human activities affect nature.

4. 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)
Introductory lesson for biology, What is life?	**Introduction;** How can we define "life"? **Examples to stimulate thoughts and discussions:** • The seven characteristics of life and the reason these are used as a definition of living systems. • Biochemical sense – nucleic acids and replication of proteins. • Self-sustaining chemical reactions? • Checking Oxford dictionary for definition **Study question;** How can we define if a plant or a mushroom is alive? **Knowledge question;** If viruses do not contain life, did they evolve from a living entity? Discussion about the three current hypotheses.

5. 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)
Ecology (topic 4)	*Carbon cycle and climate change*. Release of greenhouse gases occurs locally but has a global impact, so international cooperation to reduce emissions is essential. (WWF ecological footprint calculator, United nations homepage for statistics, lab-lesson heating up CO_2 and normal air and comparing heat retaining properties.) Discussion about how CO_2 emission correlates to standard of living and industrialization in different countries. Have anyone the right to tell others how to live?

6. 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
Plant biology (topic 9)	*Design an experiment to test hypotheses a about the effect of temperature or humidity on transpiration rates.* To formulate a hypotheses and problem statements and then design an experiment that will help them answer their questions will encourage the students to be inquirers and thinkers. The lab-rapport they will write after the experiment will aid them in developement of communication and in trying to answer their problem statements they will be guided towards beeing thinkers and practise reflectiveness and critical thinking.

This portion of the course outline highlights our IB practices. Each section gives a taste or example of how we meet the IB standards and practices in our program.

Inquiry (Approaches to Teaching 1)
You will be given opportunities to follow your interests, actively explore, or make your own choices in certain circumstances:
- Students can freely choose IA – topic, support given in adapting and limiting the topic to fit the biology course.

If you are very interested in this subject, you might wish to have certain CAS experiences that are quite connected to this subject. Some examples are:
- Create a study group for biology studies.
- Tutor the first year students in biology (when you are in year two).

Conceptual focus (Approaches to Teaching 2)
Research shows that when learning focuses on conceptual understanding, the learning is richer and more sustained. Here are some examples of places in the course where we work rather explicitly to develop conceptual understanding:
- We work with how structure affect function all through the course, in every topic.
- The concept that distinguishes universality *versus* diversity is mainly touched in topic 5 (Evolution and biodiversity)
- Equilibrium within systems is also part of every topic.
- Biological evolution is part of topic 5 (Evolution and biodiversity), topic 6 (Human physiology), topic 10 (Genetics and evolution) and topic 11 (Animal physiology).

Local and/or Global links (Approaches to Teaching 3)
Global relevance is at the heart of the DP curriculum, within nearly every subject guide, the content is already baked in. But here are some of the local links we will make in our subject:
- Ecological study of the local lake.

Collaboration (Approaches to Teaching 4)
Sometimes what you will be learning will be linked to another subject area and sometimes we as teachers like to collaborate to articulate those links for you, we find it can make learning more meaningful. How we do this may vary from year to year, but here is an example of places in the curriculum where you might find that we will work in an interdisciplinary fashion:
- There is collaboration with the math courses when we work with statistical analysis.
- Many connections to the chemistry course espessially in topic 2 (Molecular biology), 7 (Nucleic acids) and 8 (Metabolism, cellular respiration and photosynthesis)

We will also collaborate, you and I as the teacher on certain parts of the course. Some examples are:
- Learning is a shared experience; we will collaborate in different ways all the time.

And there will be times you collaborate with your classmates, such as:
- Labs in biology is mostly done in groups of maybe 3-4 students, collaboration is necessary to be successful.

Removal of barriers to learning: (Approaches to Teaching 5)
We all have our strengths and areas to develop. If you are experiencing some form of barrier to your learning, here's what I expect you will do:

- Please come and tell me about it so we can figure out a way to work around the barrier!

If I or another teacher detects that there might be a barrier to your learning, we will follow our Inclusion Policy.

Varied assessment (Approaches to Assessment 2)
These are the kinds of assessments used in this course *(prior to official IB assessments and including mocks)* :

Formative assessments:

- Some of the lab reports
- Exam style questions

Summative assessments allow for you to **consolidate your learning,** some examples of summative assessments in this course are:

- Topic tests
- Yearly mock exams
- Lab reports

Here is some information about how your work will be marked or assessed:

- All work will be marked and assessed against the course criteria.

Feedback (Approaches to Assessment 1)
You can expect to receive feedback from me on formative and summative assessments in this way:

- In person, written down and/or on teams.

You will also have an opportunity to give feedback to me in this subject, here is how:

- I will be happy to receive feedback at any time! Please tell me if you have suggestions for improvements.

To get to know our Assessment Policy in better detail, you can find it here.