Diploma Programme subject outline – Group 4: experimental sciences			
School name	Gymnázium, Šrobárova 1, Košice, Slovakia	**School code**	061626
Name of the DP subject	Biology		
Level *(indicate with X)*	Higher [ ] Standard completed in two years [X] Standard completed in one year * [ ]		
Name of the teacher who completed this outline	Martina Fabriciová	**Date of IB training**	March 2021
Date when outline was completed	June 2021	**Name of workshop** *(indicate name of subject and workshop category)*	Biology (Category 1)

* 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			Assessment instruments to be used	Resources *List the main resources to be used, including information technology if applicable.*
			One lesson is	45	minutes.		
			in one week there are	4	lessons .		
Year 1	Topic 1: Cell Biology	1.1 Introduction to Cells 1.2 Ultrastructure of Cells 1.3 Membrane Structure 1.4 Membrane Transport 1.5 The Origin of Cells 1.6 Cell Division	15 hours 20 lessons			Unit Test Quizzes Lab Activities Lab reports Oral presentations Class discussions Research projects Worksheets	Textbooks (IB DP Biology Oxford) Workbooks (IB DP Biology Oxford) Guidebooks Vernier YouTube BioNinja
	Topic 2: Molecular Biology	2.1 Molecules to metabolism 2.2 Water 2.3 Carbohydrates and Lipids 2.4 Proteins 2.5 Enzymes 2.6 Structure of DNA and RNA 2.7 DNA replication, transcription and translation 2.8 Cell Respiration 2.9 Photosynthesis	21 hours 28 lessons				
	Topic 4: Ecology	4.1 Species, Communities and ecosystems 4.2 Energy Flow 4.3 Carbon Cycling 4.4 Climate Change	12 hours 16 lessons				
	Topic 3: Genetics	3.1 Genes 3.2 Chromosomes 3.3. Meiosis 3.4 Inheritance	15 hours 20 lessons				
	Topic 5: Evolution and Biodiversity	5.1 Evidence for Evolution 5.2 Natural Selection 5.3 Classification of Biodiversity 5.4 Cladistics	12 hours 16 lessons				

Year 1 and 2	Practical Activity		20 hours 27 lessons		
	Individual Investigation		10 hours 13 lessons		
	Group 4 Project		10 hours 13 lessons		
Year 2	Topic 6: Human Physiology	6.1 Digestion and Absorption 6.2 The Blood system 6.3 Defense against infectious diseases 6.4 Gas exchange 6.5 Neurons and synapses 6.6 Hormones, homeostasis and reproduction	20 hours 27 lessons		
	Option D: Human Physiology	D.1 Human nutrition D.2 Digestion D.3 Functions of the liver D.4 The heart	15 hours 20 lessons		

Total			* 1st year (32 weeks) → 96 DP hours = 128 lessons * 2nd year (23 weeks) → 54 DP hours = 72 lessons *150 DP hours = 200 lessons		

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.

The Group 4 project will take place in the second half of the first year, with the exact date to be determined through discussion with the other IB teachers to avoid overloading the students. The total time allocated to this project shall be 10 hours. This project will likely be based on Ecology to facilitate partnering with standard level Chemistry or Physics. This topic allows for good inter-disciplinary connections with related field and laboratory work. Local opportunities are available for field and laboratory studies to develop a meaningful Group 4 project for the students.

Possible topics include:

- Rivers and water areas around the school - chemical analysis of water, monitoring of plants and animals living in the water and its vicinity
- Using bikes and dynamos to charge batteries
- The impact of pollution on flora and fauna
- The efficiency of solar panels

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

As you know, students should undergo 40 hours (at standard level) or 60 hours (at higher level) of practical work related to the syllabus. Use the table below to indicate the name of the experiment you would propose for the different topics in the syllabus. Indicate which experiments you would use for assessing each of the internal assessment criteria—design (D), data collection and processing (DCP) and conclusion and evaluation (CE).

Name of the topic	Experiment	Indicate the experiments you would use for assessing design (D), data collection and processing (DCP) and conclusion and evaluation (CE) *(use D, DCP or CE)*	Any ICT used? *Remember you must use all five within your programme.*
Topic 1- Cell Biology	Calculation of magnification of drawings, actual size of structures from drawings or micrographs (P1)	CE	The Vernier interfaces and sensors will potentially be used for every experiment, so ICT will most likely be present in some shape or form in every laboratory exercise completed in this course.
Topic 1- Cell Biology	Examine and compare the phases of mitosis in animal and plants cells. Determine the relative time cells spend in each phase of mitosis.	DCP	
Topic 1- Cell Biology	Estimation of osmolarity in tissues by bathing samples in hypotonic and hypertonic solutions (P2)	D	
Topic 2: Molecular Biology	Investigation of a factor affecting enzyme activity (P3)	D	
Topic 2: Molecular Biology	Building Macromolecules A paper-scissors-tape activity used to help students envision the process of synthesis building macromolecules out of smaller subunits	D	
Topic 2: Molecular Biology	Separation of photosynthetic pigments by chromatography (P4)	DCP,CE	
Topic 4: Ecology	Predator Prey Simulation with notecards	DCP	
Topic 4: Ecology	Attempting to create a sealed mesocosm (P5)	D	
Topic 4: Ecology	Construct a diagram of the carbon cycle	D	
Topic 3: Genetics	Drawing diagrams to show the stages of meiosis resulting in the formation of four haploid cells	D	

Name of the topic	Experiment	Indicate the experiments you would use for assessing design (D), data collection and processing (DCP) and conclusion and evaluation (CE) *(use D, DCP or CE)*	Any ICT used? *Remember you must use all five within your programme.*
Topic 3: Genetics	Genetics lab- Identifying the phenotype- and genotype for a certain characteristic (like tongue rolling) for a family tree	DCP	The Vernier interfaces and sensors will potentially be used for every experiment, so ICT will most likely be present in some shape or form in every laboratory exercise completed in this course.
Topic 3: Genetics	Construction of Punnett grids for predicting the outcomes of monohybrid genetic crosses. Comparison of predicted and actual outcomes of genetic crosses using real data Analysis of pedigree charts to deduce the patterns of inheritance of genetic diseases	DCP, CE	
Topic 5: Evolution and Biodiversity	Endangered Species or Vanishing species lab	CE	
Topic 5: Evolution and Biodiversity	Construction of dichotomous keys for use in identifying specimens	D	
Topic 5: Evolution and Biodiversity	Analysis of cladograms to deduce evolutionary relationships	DCP	
Topic 6: Human Physiology	Identification of tissue layers in transverse sections of the small intestine viewed with a microscope or in a micrograph	DCP	
Topic 6: Human Physiology	Recognition of the chambers and valves of the heart and the blood vessels connected to it in diagrams or model of heart structure	DCP	
Topic 6: Human Physiology	Monitoring of ventilation at rest and after mild and vigorous exercise (P6)	D, DCP, CE	
Option D: Human Physiology	Determination of the energy content of food by combustion	D, DCP, CE	
Option D: Human Physiology	Obtain graphical representation of the electrical activity of the heart (EKG)and a pressure pulse from the brachial artery.	DCP	

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.

Safety rules are prominently displayed on laboratory walls. The IB Biology class will be taught in a laboratory class with an attached stockroom. Chemicals and some equipment are kept in the stockroom which is lockable and ventilated and students are not allowed there without a teacher´s presence. The laboratory class has eight tables and 32 chairs. The Biology lab is equipped with a fire extinguisher and a first aid kit. The stockroom is well stocked with chemicals, glassware and other lab equipment which includes microscopes, lab coats and electronic scales. The lab is equipped with two lab sinks and teacher demonstration table where independent switches for both gas and electricity are installed. Emergency showers, or a continuous flow of water that can entirely drench a person from the top of their head are not available in the Biology laboratory, however, there is an eyewash station available there as well as fire blankets. Considering the content of IB practical work and Biology curriculum it is not required to have an emergency shower.

There are also numerous outlets in the room to plug microscopes and other electronic lab equipment. There is an independent switch for electricity that shut off all supplies in the laboratory. Safety rules are prominently displayed on laboratory walls.

There are light microscopes for students, light microscopes for teacher that can be connected with computer, Vernier devices with different probes such as *Water Quality Sensors, Water Quality Colorimeters, Turbidity Sensors, Flow Rate and Water Temperature Sensors, pH sensors, Carbon Dioxide Gas Sensors and Oxygen Gas Sensor and EKG Sensor.*

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.

There are 16 tablets and Smart Pens. Our laboratory is also equipped with an LCD projector, models of some body system and organs including skeleton model, lung model, brain model, heart model and kidney model. We also have some permanent preparation of plant and animal tissues and there are pressure gauges and stethoscopes.

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)

Topic 3: Genetics	**3.5 Genetic modification and biotechnology** The theory of knowledge makes students to reflect on how we know what we claim to know. It is important to give an opportunity for students to engage in interesting conversations that cross the boundaries of individual disciplines and that help students to reflect on the knowledge they have acquired from both their academic studies and their lives outside the classroom. Teachers should implement more open-ended questions in the class that encourage students to think critically and act actively. TOK Question: There are conflicting views as to the harms and benefits of fats in diets. How do we decide between competing views? Other corresponding TOK questions might be: How can it be that scientific knowledge changes over time? In what way have influential individuals contributed to the development of the natural sciences as an area of knowledge? Does competition between scientists help to hinder the production of knowledge? An structured discussions could be organized in the class. Students work in groups – one group are „The Nutritionists“, the second are „The Doctors“, the third are „The Chemists“ and the last one are „The Journalists“. We simulate a press conference - the teacher is a moderator. Each group has to find some information, that they present then to their classmates, there are always pros and cons. Journalists ask questions and they are asked what they think about the issue in the end. They should say who had the best speech and whether they are convinced more by the pros or cons of eating fats in diet. They should also explain how and why they are convinced by pros or cons.

7. 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 analyze 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)
Topic 1: Cell Biology **Topic 2: Molecular Biology** **Topic 3: Genetics** **Topic 4: Ecology** **Topic 5: Evolution and Biodiversity** **Topic 6: Human Physiology** **Option D: Human Physiology**	In biology classes we discuss ecological problems such as global warming, different types of pollution or excessive deforestation. We talk also about different mutations and diseases that occur worldwide. Our first biology lessons at the beginning of the year are about the history of biology and about the scientists who contributed to its development. There are many men but also women from all over the world. When we talk about the green energy we discuss how it is used in other countries. This way, we discuss many other topics such as healthy lifestyle or the environmental protection. The last activity that highlighted IM was the discussion about human genetics and the Mitochodrial Eve as we watched the documentary about the common ancestor of all living humans.

8. 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
Topic 4: Ecology **4.1 Species, Communities and ecosystems** **4.2 Energy Flow** **4.3 Carbon Cycling** **4.4 Climate Change**	We talk a lot with my students about ecology, global problems and about the possibilities of reducing our carbon footprint. At our school we celebrate International Earth Day and International Water Day - we call it The Green-Blue Day - all students, teachers and other staff of the school come dressed in blue or green and together we water the plants in the school yard and then we go to the nature to collect trash. - If you like, here are some photos – https://www.srobarka.sk/zeleno-modry-den-na-srobarke/ When we discuss water pollution and its impact on waterfowl, there is an activity – simulation an oil slick. At the beginning of the activity, students debate why the birds cannot take off from the oil slick. They express their assumptions how the weight of feathers soaked in the oil slick changes and design an experiment to simulate this situation. We weigh the bird's feather before and after soaking in the oil slick and then compare the results. We use cocoa, salt water and oil to simulate the oil slick. Students are then required to propose some solution. Developed LP statement: Thinker, Inquirer, Knowledgeable, Communicator, Principled, Caring, Reflective