IB PHYSICS 12
COURSE OUTLINE 2021/22

Teacher: Mr. Halabi

Welcome to IB Physics 12 at Semiahmoo Secondary School. This is a continuation of the IB Physics program in which you started with the IB Physics 11 course. At the end of this course, you will have covered a broader range of topics than required by the British Columbia Ministry of Education Provincial Curriculum. Refer to 'IB Physics 12 – Topics' for topics.

General goals of the course are to provide the student with

- Knowledge of Physics
- Thinking and analytic skills (theory and hands-on) to manipulate the knowledge
- An awareness of science in our daily lives
- A solid foundation for pursuing post-secondary sciences studies

Aims for the Group 4 (intended for Physics here):

Through studying biology, chemistry or physics, students should become aware of how scientists work and communicate with each other. While the scientific method may take on a wide variety of forms, it is the emphasis on a practical approach through experimental work that characterizes these subjects.

The aims enable students, through the overarching theme of the Nature of science, to:

1. Appreciate scientific study and creativity within a global context through stimulating and challenging opportunities
2. Acquire a body of knowledge, methods and techniques that characterize science and technology
3. Apply and use a body of knowledge, methods and techniques that characterize science and technology
4. Develop an ability to analyze, evaluate and synthesize scientific information
5. Develop a critical awareness of the need for, and the value of, effective collaboration and communication during scientific activities
6. Develop experimental and investigative scientific skills including the use of current technologies
7. Develop and apply 21st-century communication skills in the study of science
8. Become critically aware, as global citizens, of the ethical implications of using science and technology
9. Develop an appreciation of the possibilities and limitations of science and technology
10. Develop an understanding of the relationships between scientific disciplines and their influence on other areas of knowledge.

Assessment objectives:

The assessment objectives for biology, chemistry and physics reflect those parts of the aims that will be formally assessed either internally or externally. These assessments will center upon the nature of science. It is the intention of these courses that students can fulfill the following assessment objectives:

1. Demonstrate knowledge and understanding of:
    a. facts, concepts and terminology
    b. methodologies and techniques
    c. communicating scientific information.
2. Apply:
    a. facts, concepts and terminology
    b. methodologies and techniques
    c. methods of communicating scientific information.
3. Formulate, analyze and evaluate:
    a. hypotheses, research questions and predictions
    b. methodologies and techniques
    c. primary and secondary data
    d. scientific explanations.

4. Demonstrate the appropriate research, experimental, and personal skills necessary to carry out insightful and ethical investigations.

Connections to the core of the IB Diploma:

I) Approaches to Teaching & Learning (ATL)

Approaches to Teaching: There are 6 key principles to the approaches to teaching IB courses, the programme should be:

- Based on inquiry
- Focused on Conceptual Understanding
- Developed in local and global Context
- Focused on effective teamwork and collaboration
- Differentiation to meet the needs of all learners
- Informed by Assessment (formative and summative).

This doesn't mean that every lesson has to incorporate all of these components, but the complete 2-year course will.

Approaches to teaching refers to the way we present the course approaches to learning is about the way it is received. To receive the knowledge presented by the teacher a student must have certain skills, these can be classified in 3 ways:

- Cognitive - thinking skills, problem solving, understanding concepts.
- Metacognitive - an awareness of the different thought processes required for different tasks, thinking about thinking.
- Affective - handling emotions and behaviour.

The IB document **Approaches to teaching and learning** classifies these skills into 5 overlapping areas:

- Thinking skills,
- Communication skills,
- Social skills,
- Self management skills
- research skills

II) Theory of Knowledge (TOK)

In TOK speak, physics is an area of knowledge, so some time will be spent in the TOK classroom discussing physics as a natural science. Here are a few of the kind of questions that will come up in TOK.

Nature of physics:

- Why is physics called a "natural science"? What is and isn't physics?
- In physics are there any assumptions that are unprovable?

Methods of gaining knowledge:

- What is meant by the "scientific method"? Is the scientific method the same in all sciences? Is the scientific method the same in all cultures?
- Are the methods used in physics the same as in other sciences? What are the implications of any variations? For example, when analysing data in physics are the same methods used as in biology? How many laws of biology are there? What kinds of reasoning are used in physics?
- Physics is an experimental science, what counts as an experiment? Can experiments be undertaken in history? Can experiments be carried out in cosmology?

Knowledge claims:

- In physics we use theories and laws to make explanations, is this the same in other subjects?
- To what extent can all the natural sciences be understood through the study of just one science, for example, physics? If biology relies on chemistry, and chemistry relies on physics, can it be said that all-natural sciences are reducible to physics? If so, what would be the implications of this position?

Natural sciences and values:

- Should physics be allowed to progress without regulation or should there be some independent body that controls the direction of research? Should the funding of research be decided by business or governments?
- Are physicists morally responsible for the application of their discoveries? If someone is to be held responsible for the atom bomb how far back should be go, Bohr, Rutherford, Thomson? Should research in physics ever be stopped on moral grounds?

Physics and technology:

- Is scientific knowledge valued more for its own sake or for the technology that it makes possible? Is there any science that can be pursued without the use of technology?
- Advances in physics often lead to advancements in technology such as the mobile phone. Does it matter that although most people use a mobile phone few people understand the physical principles that it operates on. What is the difference between science and technology? Are science and technology inseparable?

Metaphor and reality:

- In physics we make great use of metaphors and analogies, gas atoms like lots of little bouncy balls, light like ripples spreading out on the surface of a pond etc. Could we have physics without analogies? Does the use of analogy ever cause problems? Is understanding the model the same as understanding reality?
- In physics, computer simulations and animations help us visualise things that we can't see. Is visualisation important? Can we understand something that we can't see? Have computer simulations removed the need for imagination?

This course requires a great deal of self-discipline from the student in terms of studying, homework, review, and self-assessment. It is essential the student always remains up to date by **reviewing materials and lessons daily (OneNote is used for classroom notes & ManageBac will be used for all file uploads and submissions)** and seeks clarification on concepts and problems by asking questions in class or in Teams.

Each lesson builds on previous lessons; therefore, it is imperative that you identify areas of confusion and difficulties and not allow them to persist, **ask questions! I am available for help every day early morning or after school in person, when possible, or Conferencing via Teams – please don't hesitate to come in for help or ask via Teams in our class chat.**

Do not let yourself fall behind. You can also email questions to me at elhalabi_l@surreyschools.ca, I will respond as quickly as possible.

Absences from class

Every class is a valuable class and therefore missing a class means you will miss something, possibly causing you to fall behind. If you do miss a class ensure you obtain from a reliable student the notes that were given and review those notes. **Notes are available on OneNote and in Class Teams**. If you still have difficulties after reviewing the notes please see me (contact me) for clarifications.

It is also your responsibility to:

i) find out about dates regarding quizzes, tests and assignments (Posted in ManageBac)
ii) to catch up

Missed Evaluations: If you miss a test or quiz due to an absence, you will be given a 'Null' mark. To be considered for a rewrite, rescheduling, or omitting of a mark, a **Parent or Guardian must make written contact with me within 3 school days.** I believe that open communication is the best way to resolve any concern.

Late Assignments: If I have returned the assignment, or if two school days have elapsed, then the assignment will not be accepted. **Acceptance will require a written explanation from your Parent / Guardian.** Late work will be marked accordingly.

Expectations

- Mature behavior and common sense is expected at all times.
- I expect you to come to class with an attitude of achievement. Respect yourself and conduct yourself with pride and dignity.
- Respect the needs of your fellow students and others' right to learn.
- I expect a focused academic tone as senior students.
- Arrive to class on time and ready to work.
- I expect active participation in class discussion and questions.
- Handle all lab equipment with care and precaution.
- I expect from you HONESTY, SELF DISCIPLINE, and the DRIVE TO SUCCEED.

Mark Breakdown

Homework, Labs & Projects	25 %
Quizzes	25 %
Unit Exams	50 %
Class Mark Total	100 %

Physics marks and modified weighting for 2021/2022

	Component	Current number of marks	Modified number of marks for 2021/2022	Current weighting	Modified weighting for 2021/2022
HL	**Paper 1**	40	**40**	20%	**30%**
	Paper 2	90	**90**	36%	**50%**
	Paper 3	45	**Removed**	24%	**N/A**
	IA	24	**24**	20%	**20%**
	Total weighting			100%	**100%**

IB PHYSICS 12 – TOPICS

Note: As the IB Physics HL Syllabus is covered in about 2.5 semesters over the grade 11 & 12 years, actual coverage in this outline may vary depending on the needs/coverage from last years' grade 11 topics.

Here is a link to the IB Physics Guide- First assessment 2016

https://ibpublishing.ibo.org/server2/rest/app/tsm.xql?doc=d_4_physi_gui_1402_1_e&part=3&chapter=1

Teaching Order	Syllabus	Topic	Day
		Physics & Measurements	
	1.1	The realm of physics (review)	
	1.2	Measurement and uncertainties (review)	
	1.3	Vectors and scalars (review)	
		Mechanics	
		Mechanics	
	2.1	Kinematics (review)	
	2.2	Force and dynamics (review)	
	2.3	Work, energy and power (review)	
	2.4	Momentum & Impulse (review)	
		Circular motion & Gravitation	
	6.1	Circular motion	
	6.2	Newton's law of gravitation	
	10.1	Gravitational field	
	10.2	Potential, potential energy, Pot. Difference, Escape speed & Orbital motion ,…	
		Thermal Physics	
	3.1	Thermal concepts (review)	
	3.2	Modeling a gas (review)	
		Energy Production	
	8.1	Energy sources	
	8.2	Thermal energy transfer	
		Oscillations & Waves	
		Oscillations & Wave phenomena	

	9.1	Kinematics of simple harmonic motion	
	9.1	Energy changes during simple harmonic motion	
	4.1& 4.2	Oscillations & travelling waves (review)	
	4.3	Wave characteristics (review)	
	4.4	Wave properties (review)	
	4.5	Standing waves (review)	
	9.2	Single-slit diffraction	
	9.3	Interference	
	9.4	Resolution	
	9.5	Doppler effect	
		Electricity and Magnetism	
	5.1	Charge & Coulomb's law	
	10.1	E fields & Electric Potential	
	10.1	Field lines & Equipotential surfaces	
	10.2	Fields at work	
	5.1	Electric current, direct current(dc), potential difference(pd)	
	5.2	Heating effect of electric currents	
	5.3	Electric cells	
	11.2	Power generation & transmission	
	11.2	Transformers, Diode bridges, Half-wave and full-wave rectification	
	11.3	Capacitance	
	5.4	Magnetic effects of electric currents	
	11.1	Electromagnetic induction	
	11.1	emf, Magnetic flux and linkage, Faraday's law for induction & Lenz's law	
		Quantum & Nuclear	
		Atomic, Nuclear & Particle Physics	
	7.1	Discrete energy and radioactivity	
	7.2	Nuclear reactions	
	7.3	The structure of matter	
		Quantum and Nuclear	

	12.1	The interaction of matter with radiation	
	12.2	Nuclear physics	
NOT Included This Year as Per IB Request to omit Paper 3 from exams		Special & General Relativity (Option **A**)	
	A.1	The beginning of relativity	
	A.2	Lorentz transformations	
	A.3	Spacetime diagrams	
	A.4	Relativistic mechanics	
	A.5	General relativity	

The flow chart below is part of an interactive flow chart showing the scientific process of inquiry in practice. The interactive version can be found at “How science works: The flowchart.” Understanding Science.

University of California Museum of Paleontology. 1 February 2013 <http://undsci.berkeley.edu/article/scienceflowchart>.