

# Physics 12 (IB) Course Outline

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## Objectives:

Physics 12 (IB) is the conclusion of a two year experimental science programme dealing with the basic concepts and skills in the science of physics.

### Group 4 aims

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 analyse, 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

## Textbook:

Tsokos, K. A. Physics for the IB Diploma, 2014, Cambridge University Press., Cambridge.

## Topics:

**\*Taught in grade 11**

Core	Topic 3: Thermal physics	Topic 5: Electricity and magnetism	Topic 7: Atomic, nuclear and particle physics
<i>Topic 1: Measurements and uncertainties</i>	3.1 – Thermal concepts * 3.2 – Modelling a gas *	5.1 – Electric fields 5.2 – Heating effect of electric currents * 5.3 – Electric cells *	7.1 – Discrete energy and radioactivity 7.2 – Nuclear reactions 7.3 – The structure of matter
1.1 – Measurements in physics * 1.2 – Uncertainties and errors * 1.3 – Vectors and scalars *	<i>Topic 4: Waves</i> 4.1 – Oscillations 4.2 – Travelling waves * 4.3 – Wave characteristics* 4.4 – Wave behaviour 4.5 – Standing waves *	5.4 – Magnetic effects of electric currents	<i>Topic 8: Energy production</i> 8.1 – Energy sources 8.2 – Thermal energy transfer
<i>Topic 2: Mechanics</i> 2.1 – Motion * 2.2 – Forces * 2.3 – Work, energy and power * 2.4 – Momentum and impulse *		<i>Topic 6: Circular motion and gravitation</i> 6.1 – Circular motion 6.2 – Newton’s law of gravitation	

<b>Additional higher level (AHL)</b>	<i>Topic 10: Fields</i>	<i>Option B: Engineering physics</i>
<i>Topic 9: Wave phenomena</i>	10.1 – Describing fields 10.2 – Fields at work	<b>Core topics</b>
9.1 – Simple harmonic motion	<i>Topic 11: Electromagnetic induction</i>	B.1 – Rigid bodies and rotational dynamics B.2 – Thermodynamics
9.2 – Single-slit diffraction	11.1 – Electromagnetic induction	<b>Additional higher level topics</b>
9.3 – Interference	11.2 – Power generation and transmission	B.3 – Fluids and fluid dynamics (HL only)
9.4 – Resolution	11.3 – Capacitance *	B.4 – Forced vibrations and resonance (HL only)
9.5 – Doppler effect *	<i>Topic 12: Quantum and nuclear physics</i>	
	12.1 – The interaction of matter with radiation 12.2 – Nuclear physics	

## Expectations:

### As IB learners we strive to be:

#### **INQUIRERS**

We nurture our curiosity, developing skills for inquiry and research. We know how to learn independently and with others. We learn with enthusiasm and sustain our love of learning throughout life.

#### **KNOWLEDGEABLE**

We develop and use conceptual understanding, exploring knowledge across a range of disciplines. We engage with issues and ideas that have local and global significance.

#### **THINKERS**

We use critical and creative thinking skills to analyse and take responsible action on complex problems. We exercise initiative in making reasoned, ethical decisions.

#### **COMMUNICATORS**

We express ourselves confidently and creatively in more than one language and in many ways. We collaborate effectively, listening carefully to the perspectives of other individuals and groups.

#### **PRINCIPLED**

We act with integrity and honesty, with a strong sense of fairness and justice, and with respect for the dignity and rights of people everywhere. We take responsibility for our actions and their consequences.

#### **OPEN-MINDED**

We critically appreciate our own cultures and personal histories, as well as the values and traditions of others. We seek and evaluate a range of points of view, and we are willing to grow from the experience.

#### **CARING**

We show empathy, compassion and respect. We have a commitment to service, and we act to make a positive difference in the lives of others and in the world around us.

#### **RISK-TAKERS**

We approach uncertainty with forethought and determination; we work independently and cooperatively to explore new ideas and innovative strategies. We are resourceful and resilient in the face of challenges and change.

#### **BALANCED**

We understand the importance of balancing different aspects of our lives—intellectual, physical, and emotional—to achieve well-being for ourselves and others. We recognize our interdependence with other people and with the world in which we live.

#### **REFLECTIVE**

We thoughtfully consider the world and our own ideas and experience. We work to understand our strengths and weaknesses in order to support our learning and personal development.

PMSS's **IB Academic Honesty Policy** is expected to be followed at all times. Please refer to it on the school's website, and make sure you understand all of the expectations.

- You are expected to work on your own to complete all assignments. Lab partners may collect data together, but the presenting of the data, calculations, discussions and conclusions in labs write ups must be completed **independently**. Working together constitutes academic dishonesty and is a form of plagiarism that is not acceptable.
- Plagiarism is not tolerated in any form. You may not use material from the internet, or print material, without referencing. Work done by a tutor and previous course work from a friend is considered plagiarism. Any work completed under these conditions will receive a zero, no exceptions.
- All lab work and assignments must be handed in on time, at the beginning of class. If something needs to be printed, it must be done ahead of time, and be ready to hand in at the start of class.
- You will receive 2 types of assessment on report cards, a percentage based on your understanding of the learning outcomes and a work habits grade. In order to receive a "G" work habit, you will need to complete all assignments on time and PARTICIPATE in class. Ask lots of questions, volunteer answers and be actively involved in discussions.

## Evaluation:

Students will be assessed through a variety of assignments, labs, and tests. Each topic will be weighted to reflect the number of learning outcomes that the students must meet. The final IB grade will be on a 7 point scale, which will reflect only their performance on their exams in May of grade 12 and their internal assessment.

For report cards, the current estimated IB grades will be converted to a percentage based on the following chart, which has been approved by the BC Ministry of Education and adopted by BCAIBWS.

Current Estimated IB grade	7	6	5	4	3	2	1
Report Card %	98-100	96-97	90-95	86-89	76-85	70-75	0-69

## **Class marks:**

### Class work and Laboratory work

#### 1. *Homework questions*

Students are expected to complete all assigned homework questions and relevant questions from the text book. Irregularity in students' homework completion will be reflected in their achievement and work habit marks.

#### 2. *Lab activities*

Lab reports will be assigned throughout this course. Lab reports must follow the accepted IB format to receive full marks.

### Tests

Tests will occur at appropriate points during the quarter to evaluate students' understanding of the previous unit. Students will be notified before all forthcoming tests.

## **Final IB mark:**

### IB Internal Assessment

In addition to the laboratory work performed in the classroom, an "Internal assessment" report is required. It enables students to demonstrate the application of their skills and knowledge, and to pursue their personal interests, without the time limitations and other constraints that are associated with written examinations. "Internal Assessment" counts for 20% of the overall IB assessment.

### IB External Assessment

"External Assessment" is a comprehensive examination that covers all topics in the IB syllabus (i.e. both 11(IB) and 12(IB) topics). The "External Assessment" consists of three papers written over two days and accounts for 80% of the overall IB assessment. The exams will be in May 2017

#### **Paper 1 (1 hour)**

- 40 multiple-choice questions on core and AHL, about 15 of which are common with SL.
- The questions on paper 1 test assessment objectives 1, 2 and 3.
- The use of calculators is not permitted.
- No marks are deducted for incorrect answers.
- A physics data booklet is provided.

#### **Paper 2 (2¼ hours)**

- Short-answer and extended-response questions on the core and AHL material.
- The questions on paper 2 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.

#### **Paper 3 (1¼ hours)**

- This paper will have questions on core, AHL and option material.

- Section A: one data-based question and several short-answer questions on experimental work.
- Section B: short-answer and extended-response questions from one option.
- The questions on paper 3 test assessment objectives 1, 2 and 3.
- The use of calculators is permitted. (See calculator section on the OCC.)
- A physics data booklet is provided.

### 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 centre upon the nature of science. It is the intention of these courses that students are able to 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, analyse 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.

### Assessment Outline:

#### Standard Level:

Component	Overall weighting (%)	Approximate weighting of objectives (%)		Duration (hours)
		1+2	3	
Paper 1	20	10	10	¾
Paper 2	40	20	20	1¼
Paper 3	20	10	10	1
Internal assessment	20	Covers objectives 1, 2, 3 and 4		10

#### Higher Level:

Component	Overall weighting (%)	Approximate weighting of objectives (%)		Duration (hours)
		1+2	3	
Paper 1	20	10	10	1
Paper 2	36	18	18	2¼
Paper 3	24	12	12	1¼
Internal assessment	20	Covers objectives 1, 2, 3 and 4		10

### Approaches to Teaching and Learning

The IB Diploma Programme Approaches to Teaching and Learning are deliberate strategies, skills, and attitude that permeate the IB Teaching and Learning environment. The IB believes that a large influence on a student's education is not only what you learn by how you learn. Teaching students how to learn will improve the quality of teaching and learning across the entire IB spectrum of programmes.

The IB approaches to learning skills are:

- Thinking skills
- Communication skills
- Social skills
- Self-management skills
- Research skills

The IB approaches to teaching skills are:

- based on inquiry
- focused on conceptual understanding
- developed in local and global contexts
- focused on effective teamwork and collaboration
- differentiated to meet the needs of all learners
- informed by formative and summative assessment.

### Links to Theory of Knowledge

- In Theory of Knowledge, students will be introduced to 8 “Ways of Knowing”. Through IB Biology, we will also discuss how scientists use Reason, Language, Sense Perception, Intuition, Imagination and Memory in order to increase and communicate scientific knowledge.

### International Mindedness

- Science itself is an international endeavour—the exchange of information and ideas across national boundaries has been essential to the progress of science. Indeed, the idea that science is a Western invention is a myth—many of the foundations of modern-day science were laid many centuries before by Arabic, Indian and Chinese civilizations, among others. The scientific method in its widest sense, with its emphasis on peer review, open-mindedness and freedom of thought, transcends politics, religion, gender and nationality. Increasingly there is a recognition that many scientific problems are international in nature and this has led to a global approach to research in many areas.
- Throughout the two year of IB Physics, students will be introduced to examples of international efforts working together to increase scientific knowledge and examine how scientific breakthroughs affect people in different regions of the world.