TORONTO INTERNATIONAL OSLIFE SCHOOL
COURSE OUTLINE

Physics, Grade 12, University Preparation

Name of School: Toronto International Oslife School
Department: Science
Course Developer: Bill Shaw, B.A. (Honours), B.Ed., OCT
Course Development Date: June 2021
Course Title & Grade: Physics, Grade 12
Ministry Course Code: SPH4U
Course Type: University Preparation
Credit Value: 1.0
Developed from: The Ontario Curriculum, Grades 11 & 12, Science, 2008 – Revised
Prerequisite: Physics, Grade 11, University Preparation

COURSE DESCRIPTION:

This course develops students' understanding of the basic concepts of physics. Students will explore kinematics, with an emphasis on linear motion; different kinds of forces; energy transformations; the properties of mechanical waves and sound; and electricity and magnetism. They will enhance their scientific investigation skills as they test laws of physics. In addition, they will analyze the interrelationships between physics and technology, and consider the impact of technological applications of physics on society and the environment.

CURRICULUM OVERALL EXPECTATIONS:

A. SCIENTIFIC INVESTIGATION AND CAREER EXPLORATION

A1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);

A2. identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.

B. DYNAMICS

B1. analyze technological devices that apply the principles of the dynamics of motion, and assess the technologies' social and environmental impact;

B2. investigate, in qualitative and quantitative terms, forces involved in uniform circular motion and motion in a plane, and solve related problems;

B3. demonstrate an understanding of the forces involved in uniform circular motion and motion in a plane.

C. ENERGY AND MOMENTUM

C1. analyze, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures;

C2. investigate, in qualitative and quantitative terms, through laboratory inquiry or computer simulation, the relationship between the laws of conservation of energy and conservation of momentum, and solve related problems;

C3. demonstrate an understanding of work, energy, momentum, and the laws of conservation of energy and conservation of momentum, in one and two dimensions.

D. GRAVITATIONAL, ELECTRIC AND MAGNETIC FIELDS

D1. analyze the operation of technologies that use gravitational, electric, or magnetic fields, and assess the technologies' social and environmental impact;
D2. investigate, in qualitative and quantitative terms, gravitational, electric, and magnetic fields, and solve related problems;
D3. demonstrate an understanding of the concepts, properties, principles, and laws related to gravitational, electric, and magnetic fields and their interactions with matter.

E. THE WAVE NATURE OF LIGHT

E1. analyze technologies that use the wave nature of light, and assess their impact on society and the environment;
E2. investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems;
E3. demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization.

F. REVOLUTIONS IN MODERN PHYSICS: QUANTUM MECHANICS AND SPECIAL RELATIVITY

F1. analyze, with reference to quantum mechanics and relativity, how the introduction of new conceptual models and theories can influence and/or change scientific thought and lead to the development of new technologies;
F2. investigate special relativity and quantum mechanics, and solve related problems;
F3. demonstrate an understanding of the evidence that supports the basic concepts of quantum mechanics and Einstein's theory of special relativity.

COURSE CONTENT:

Unit Name	Time Allocation
1. Kinematics	24.5
2. Dynamics	19
3. Energy and Momentum	21.5
4. Fields	21
5. Wave and Quantum	21
8. Final Assessment	3
Total Hours	**110**

TEACHING & LEARNING STRATEGIES:

Direct Instruction (teacher-led)	✓	Class Activity (teacher facilitation)	
Direct Instruction (discussion possible)		Experiential learning (learn by doing)	✓
Class Discussion (teacher facilitated)	✓	Worksheets/Surveys	✓
Small Group Discussion		Individual or Group Research	✓

Partner Discussion/Conferencing		Teacher modeling	
1:1 Conferencing Teacher & Student		Text-based modeling	
Teacher reading to class	✓	Use of Computers / Internet	✓
Silent individual reading	✓	Use of video or audio materials	✓
Group based reading		Role Playing	
Independent Work (teacher facilitation)		Presentations	✓
Group Work (teacher facilitation)		Guest Speaker / Interviews / Questions	
Brainstorming		Field Trip	

ASSESSMENT & EVALUATION:

Purpose: The primary purpose of assessment is to improve student learning. Assessment relates directly to the expectations for the course.

A variety of assessments for and as learning are conducted on a regular basis to allow ample opportunities for students to improve and ultimately demonstrate their full range of learning and in order for the teacher to gather information to provide feedback. Assessment tasks relate to the success criteria set out in lesson plans. Success criteria allow students to see what quality looks like.

Evaluation is the process of judging the quality of student work in relation to the achievement chart categories and criteria, and assigning a percentage grade to represent that quality. Evaluation is based on gathering evidence of student achievement through:

- Products
- Observations
- Conversations

Assessment *for* Learning - we provide feedback and coaching
Assessment FOR Learning is the process of seeking and interpreting evidence for the use of learners and their teachers to decide where the learners are in their learning, where they need to go, and how best to go there.

Assessment *as* Learning - we help students monitor progress, set goals, reflect on their learning
Assessment AS Learning is the process of the explicit fostering of students' capacity over time to be their own best assessors, but teachers need to start by presenting and modeling external, structured opportunities for students to assess themselves.

Assessment *of* Learning – we use assessments as ways of providing evaluative statements about the level of achievement of students
Assessment OF Learning is the assessment that becomes public and results in statements of symbols (marks/grades/levels of achievement) about how well students are learning. It often contributes to pivotal decisions that will affect students' future.

Grading

- The final grade is based on performance in 3 areas: products, observations and conversations.
- 70% of the grade is based on evaluations conducted throughout the course.
- 30% is based on a final evaluation.

Weighting of Categories:

Knowledge & Understanding	Thinking	Communication	Application
30%	30%	20%	20%

Assessment Tools: The following assessment tools are used in SPH4U at TIOS:

Marking schemes	✓	Rubrics	✓
Anecdotal comments		Checklists	
Rating Scales			

Assessment Strategies: The following assessment strategies are used in SPH4U at TIOS:

Assessment for Learning		Assessment as Learning		Assessment of Learning	
Quizzes	✓	Journal		Tests	✓
Tests		Exit and Entrance Cards	✓	Presentations	✓
Presentations	✓	KWL Chart	✓	Journals	
Journals	✓	Self/Peer assessment	✓	Essays	
Essays		Logs		Models	
Models				Projects	✓
Projects				Demonstrations	✓
Demonstrations	✓			Conferencing	
Conferencing				Questioning	
Questioning				Independent Study Assignment	✓
Independent Study Assignment	✓			Art Exhibits	
Art Exhibits				Researching	
Researching				Reading Aloud	
Reading Aloud				Problem Solving (process focused)	
Problem Solving (process focused)				Debates	
Debates				Work Sheets	✓
Work Sheets	✓			Role Playing	
Role Playing				Direct Instruction	
Direct Instruction				Online Experiments	✓
Online Experiments	✓				

CONSIDERATIONS FOR PROGRAM PLANNING:

Instructional Approaches

Teachers at TIOS are expected to:

- clarify the purpose for learning;
- help students activate prior knowledge;
- differentiate instruction for individual students and small groups according to need;
- explicitly teach and model learning strategies;
- encourage students to talk through their thinking and learning processes;
- provide many opportunities for students to practise and apply their developing knowledge and skills;
- apply effective teaching approaches involve students in the use of higher-level thinking skills;
- encourage students to look beyond the literal meaning of texts and artistic works;
- encourage students to rehearse, practice, apply, skills and strategies, and to make their own choices.

Teachers use a variety of instructional and learning strategies best suited to the particular type of learning. Students have opportunities to learn in a variety of ways:

- individually;
- cooperatively;
- independently with teacher direction;
- through investigation involving hands-on experience;
- through examples followed by practice;
- by using concrete learning tools;
- by encouraging students to gain experience with varied and interesting applications of the new knowledge. Rich contexts for learning open the door for students to see the “big ideas” of mathematics that will enable and encourage them;

Program Considerations for Students with Special Education Needs

Teachers must incorporate appropriate strategies for instruction and assessment to facilitate the success of students with special education needs in their classrooms. These strategies stem from the beliefs as laid out in *Special Education Transformation: The report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006*:

- All students can succeed.
- Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students.
- Successful instructional practices are founded on evidence-based research, tempered by experience.
- Classroom teachers are key educators for a student’s literacy and numeracy development.
- Each student has his or her own unique patterns of learning.
- Classroom teachers need the support of the larger community to create a learning environment that supports students with special education needs.
- Fairness is not sameness.

Teachers must plan their program that recognize the diversity of students' learning styles, needs, and responses, so students can have performance tasks that respect their abilities so they can derive the greatest possible benefit from the teaching and learning process.

Teachers must be mindful of three types of accommodations for students:

- Instructional Accommodations: changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia
- Environmental Accommodations: changes that the student may require in the classroom and/or school environment, such as preferential seating or special lighting.
- Assessment accommodations: changes in assessment procedures that enable the student to demonstrate his or her learning, such as allowing additional time to complete tests or assignments, or permitting oral responses to test questions

No modifications to course expectations are made at this school.

Program Considerations for English Language Learners

TIOS Teachers will use appropriate strategies for instruction and assessment to facilitate the success of the English language learners in their classrooms. These strategies include (but are not limited to):

- modification of some or all of the subject expectations depending on the level of English proficiency;
- use of a variety of instructional strategies (e.g., extensive use of visual cues, graphic organizers, scaffolding;
- previewing of textbooks;
- pre-teaching of key vocabulary;
- peer tutoring;
- strategic use of students' first language;
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries and materials that reflect cultural diversity;
- use of assessment accommodations (e.g., granting of extra time); and
- use of oral interviews, demonstrations or visual representations or tasks requiring completion of graphic organizers and cloze sentences instead of essay questions and other assessment tasks that depend heavily on proficiency in English.

Environmental Education in the Science Classroom

Environmental education is education about the environment, for the environment, and in the environment that promotes an understanding of, rich and active experience in, and an appreciation for the dynamic interactions of:

- The earth's physical and biological systems
- The dependency of our social and economic systems on these natural systems
- The scientific and human dimensions of environmental issues
- The positive and negative consequences, both intended and unintended, of the interactions between human-created and natural systems. Shaping Our Schools, Shaping Our Future: Environmental Education in Ontario Schools (June 2007), p. 6

As our understanding of technology changes, our reliance on it increases. Further, the effects of this technology on the environment change even more rapidly. Students must have the understanding of the effects of technology on not only society, but the environment as well. This must be carefully discussed and introduced with students to

build a stronger, more efficient student of the sciences, as well as a more informed Canadian citizen.

There are a number of situations where students can be improving their "environmental literacy" throughout the course. Some examples from the Ministry of Education's curriculum documents are:

- A sense of place can be developed as students investigate natural and human factors that influence Earth's climate.
- An understanding of the effects of human activity on the environment can develop as students consider the impact of their actions (e.g., taking part in tree planting at a local park, walking or biking to school instead of riding in the car, packing a litterless lunch) on their local environment.

Systems thinking can be developed as students understand what a system is and how changing one part of it (e.g., introducing zebra mussels into a local lake or non-native invasive plants into a wetland) can affect the whole system

Equity & Inclusion

At Toronto International OSLIFE School, our mission is to inspire academic excellence for students and strong confidence for parents.

The following statements of belief are excerpted from the Peel District School Board document entitled *Empowering Modern Learners (Addendum 2020)* and help us to shape a foundation that determines our school's belief system about our students.

As a school, we are committed to ensuring that each student is represented and reflected in the learning experiences and learning environments we provide. This means that teachers and administrators at TIOS celebrate and value unique student interests, backgrounds, cultures and prior experiences. Our beliefs as a staff are founded on the following belief system that we bring to classrooms every day:

- We must actively confront inequities and barriers that uphold racism and other forms of oppression so learners of all identities are empowered through education that embraces their identities and lived experiences.
- Each learner is curious, competent and able to take an active role in his or her own learning.
- Effective educators empower all learners to achieve personal excellence by being open, flexible and responsive to their needs.
- A positive, innovative learning environment empowers all of us to grow through rich, authentic relationships both locally and globally.
- Together as a community of families, educators and leaders, we share responsibility to inspire our modern learners to be active, critically engaged, global citizens.

Culturally responsive pedagogy and modern digital tools offer unprecedented opportunities to empower historically under-served learners by providing barrier-free access to information and learning networks. This access generates new opportunities for learners to explore their passions, share their voices and consider diverse perspective.

Being an educator that embodies Modern Learning is more about the journey than the destination. As we acknowledge our past and commit to a new future, we will focus on instructional strategies that take in consideration student learning needs, and assessment

practices that are equitable, transparent and focus on student achievement. Our classroom must foster critical thought, adaptability and innovation and understanding that these concepts look different and have different implications for each learner.

Literacy and Inquiry/Research Skills
TIOS emphasizes the importance of the following:

- using clear, concise communication in the classroom involving the use of diagrams, charts, tables, and graphs
- emphasizing students' ability to interpret and use graphic texts.
- acquiring the skills to locate relevant information from a variety of sources, such as books, newspapers, dictionaries, encyclopaedias, interviews, videos, and the Internet.
- learning that all sources of information have a particular point of view
- learning that the recipient of the information has a responsibility to evaluate it, determine its validity and relevance, and use it in appropriate ways.

The Role of Technology
Information and communications technologies (ICT) tools used in many ways:

- Students use multimedia resources, databases, Internet websites, digital cameras, and word-processing programs.
- Students use databases, spreadsheets, dynamic geometry and statistical software, graphing software, computer algebra systems, and so on in order to quickly navigate through complex problems, to see the effect of dynamic data on their values and trends, and to see a graphical representation of data.
- They use technology to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings.
- Students are encouraged to use ICT to support and communicate their learning. For example, students working individually or in groups can use computer technology and/or Internet websites to gain access to museums and archives in Canada and around the world.
- Students use digital cameras and projectors to design and present the results of their research to their classmates.
- The school plans to use ICT to connect students to other schools and to bring the global community into the classroom.
- Students are made aware of issues of Internet privacy, safety, and responsible use, as well as of the potential for abuse of this technology, particularly when it is used to promote hatred.

Career Education
Students are given opportunities to develop career-related skills by:

- applying their skills to work-related situations;
- exploring educational and career options;
- developing research skills;
- developing key essential skills such as reading text, writing, computer use, measurement and calculation, and problem solving;
- practising expository writing;
- learning strategies for understanding informational reading material;
- making oral presentations;

- working in small groups with classmates to help students express themselves confidently and work cooperatively with others.

Health and Safety in Science Classrooms

At Brain Power, not only is the instruction and learning of the course content important to us, the health and safety aspects of scientific study is just as crucial. Studies in science, more than almost any other course, is inherently risky. Whether it is through using reactive chemicals; small, fine instruments; DC and AC electricity; or even observing natural phenomena in the wild, students must be conscious of the safety considerations for themselves, those that are surrounding them, and those that may be impacted after experiments and observations have concluded.

For students to study safely in the classroom, teachers must have:

- concern for their own safety and those of their students;
- the requisite knowledge to use materials, equipment, and procedures involved in the safe study of science
- knowledge of the appropriate means to care for all living things brought in to the classroom
- skills needed to perform tasks safely and efficiently

Students can demonstrate that they have the appropriate knowledge, skills, habits, and attitude for safe participation in the science classroom by:

- maintaining a well organized and uncluttered workspace
- following established safety procedures
- identifying possible safety concerns, whether from their own study or others
- suggesting and implementing appropriate safety procedures
- carefully following the instruction and examples of the teacher
- consistently show care and concern for their own safety and that of others.

Teachers, within reason, are encouraged to provide students with opportunities and ideas to get out-of- classroom learning in the sciences as it helps build strong real world skills, and helps student connect their learning to the real world. Should these opportunities be provided for students, teachers must plan ahead for the unpredictable nature of these events to protect students' health and safety.

Financial Literacy

The school is emphasizing the importance of ensuring that Ontario students have the opportunity to improve their financial literacy. Financial literacy is defined as "having the knowledge and skills needed to make responsible economic and financial decisions with competence and confidence". The goal is to help students acquire the knowledge and skills that will enable them to understand and respond to complex issues regarding their own personal finances and the finances of their families, as well as to develop an understanding of local and global effects of world economic forces and the social, environmental, and ethical implications of their own choices as consumers. Thus, an attempt will be made to integrate Financial Literacy in all the school's courses.

Financial Literacy in the context of science can be as simple as discussing the costs of various scientific resources and examining various reasons in a business and technological sense on why these resources cost what they do, to more complex means of recreating laboratory experiments with common household materials (in a responsible and safe manner), and discussing the limitations and changes to the experiment that this may produce.

Academic Honesty

Plagiarism occurs when someone presents the work of others as their own. This would include copying large amounts of text from the Internet or other written texts without crediting the original author. Plagiarism also occurs when someone copies the work of other students, pretending it to be their own. Surprisingly, the third instance of plagiarism occurs when a student copies an assignment from one course for use in a different course, pretending it to be original work. All three of these instances constitute plagiarism and are very serious breaches of academic honesty.

In many post-secondary institutions, students who are found to be guilty of academic dishonesty (plagiarism) are forced to withdraw from the course and/or the university.

At TIOS, we consider the issue of academic honesty to be very important. Since our goal is to inspire academic excellence for students, we believe that academic honesty is an important lesson to learn during high school. For this reason, teachers in each course will review the correct methods of footnoting sources so that students can avoid any suspicion of copying from outside sources. Using someone else's ideas to support your own is not the crime – but when you pretend that someone else's ideas are yours, that becomes the problem! Teachers throughout Ontario have access to online software that easily detects plagiarism, so it is important for students to pay careful attention to this issue.

As outlined in *Growing Success*, students must understand that the tests/exams they complete and the assignments they submit for evaluation must be their own work and that cheating and plagiarism will not be condoned.

- **Responsibilities of TIOS Students:** When the teacher asks you to use your own words and ideas, it means that you should use your own words and your own ideas. You must demonstrate to the teacher that you are capable of submitting work that is your own. When a teacher asks to put your ideas into your own words, it does not mean that there is a correct answer for the assignment. It means that you have to come up with your own ideas to give to the teacher.

- **Responsibilities of TIOS Teachers:** Teachers will help students avoid plagiarising by using some of the following strategies:
  - defining the term "plagiarism" and reminding students of the policy when setting out an assignment;
  - giving students examples of what plagiarism looks like;
  - emphasizing the importance of using process skills to arrive at a product;
  - teaching students research skills so they can avoid plagiarising: note taking, paraphrasing, summarizing;
  - teaching students organizational skills: finding and organizing information to build understanding of a topic;
  - teaching students how to make an outline for a report or research essay;
  - having students keep a learning log to reflect on what they learned through the process: how research and organizational skills helped with the project, how could the product be improved, how can the research and organizational skills be improved;
  - assessing the process steps: notes, outline, summary, bibliography, drafts, etc.; and/or
  - informing students of the consequences of plagiarism.

Consequences for Academic Dishonesty at TIOS

Students found to have plagiarized assignments at TIOS will be subject to a series of escalating consequences:

- Instance #1: When plagiarism has been detected, the teacher will discuss the matter with the student. Both parents and the Principal will be informed of the details and the student will have the opportunity of redoing the assignment in a way that avoids plagiarism.
- Instance #2: When plagiarism is detected a second time, the student will receive a mark of zero for the assignment. Parents and the Principal will once again be informed and the Principal will note this in their school records.
- Instance #3: Repeat instances of plagiarism may result in withdrawal from the course and/or the school without refund of tuition. Similarly, students who are guilty of cheating on tests or examinations will receive a mark of zero on the test or examination and these details will also be noted in their school records.

Appeal

- A student may appeal the teacher's decision to the Principal after discussion with the teacher.

Late Assignments

Students are responsible for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher and in a format approved by the teacher. There are consequences for not completing assignments for evaluation or for submitting those assignments late.

Resources

- Nelson Physics 12 University Preparation, Nelson Education Ltd. © 2012
- Moodle Website
- Dictionaries, Thesaurus etc.
- Various Daily Newspapers, Magazines, and Periodicals (Audio and Video material) CBC, The Fifth Estate, etc.
- Various Internet Resources:
  - The University of Toronto Library
  - OWL English Purdue
  - The Ontario Ministry of Health and Long Term Care
  - The Toronto Star
  - The Globe and Mail