Physics 20 Course Outline

Peace River High School
February 2009

Course Philosophy

In Physics 20, the students will develop their ability to ask questions, investigate and experiment, to gather, analyze and assess scientific information; and to test scientific laws and principles and their applications. Through these processes, students exercise their creativity and critical thinking skills. An in depth study of how and why objects move as well as their impact or relevance to our daily lives will be undertaken. In this manner, the course shall endeavour to engender an appreciation of scientific processes; our dependence on these forces as well as evaluate their impact may have on other systems.

This course shall nurture the view that education is a life-long process towards betterment and that the study of science and technology is a means of learning about oneself and one's place in a rapidly shrinking global context. It is therefore hoped that students will learn about themselves in addition to the course material. To ensure such learning occurs, active participation on the part of the student is essential.

Goals of the Physics 20 Programme

According to the Program of Studies, the major goals of the Physics 20 curriculum are:

- To develop in students an understanding of the interconnecting ideas and principles that transcend and unify the natural science disciplines
- To provide students with an enhanced understanding of the scientific world view, inquiry and enterprise
- To help students attain the level of scientific awareness essential for all citizens in a scientifically literate society
- To help students make informed decisions about further studies and careers in science
- To provide students with opportunities for acquiring knowledge, skills and attitudes that contributes to personal development.

Course Outline

Unit objectives, textbook pages, workbook pages, and tentative dates.

The following is the course outline listing the approximate percentage of time spent on each of the four units, the approximate time line, and related chapters in the textbook

Unit 1: Kinematics (15%)

- Chapters 1 & 2
- Sept 1 – Sept 21

Unit 2: Dynamics (25%)

- Chapters 3 & 4
- Sept 22 – Oct 26

Unit 3: Circular Motion, Work, and Energy (30%)

- Chapters 5 & 6
- Oct 27 – Dec 3

Unit 4: Oscillatory Motion and Mechanical Waves (30%)

- Chapters 7 & 8
- Dec 5 – Jan 23

General Expectations

- **Regular attendance** – To be successful in Physics 20, the student must be attending classes and completing the work associated with learning the concepts and skills of the course. The student is responsible for getting notes and doing the work that was assigned if they are absent/late. If the student knows that they will be away, please notify the teacher so the student can pick up their work so they do not fall behind.

- **Arrive on time/be prepared** – It is expected that you are in your desk ready to start class when the bell goes. If you are unable to avoid being late, please enter the classroom with a minimum of disruption. Books, pencils, calculators, data booklets, etc. are to be brought to class everyday. Handouts, quizzes, assignments, notes and exams are to be kept in order in a binder.

- **Work Habits** – It is expected that the student use their class time to the best of their abilities for the whole period every class. I expect everyone to be listening when I am providing instruction. Please raise your hand and ask questions at any time during the class. Respectful behaviour is a necessity to all members of the class and shall be reciprocated.

- **Homework/Exams** – Homework assignments are due at the beginning of each class. It is the student's responsibility to make up for any work missed during an absence. If an exam or quiz is missed due to an excused absence, the student will be allowed to write the exam on his or her own time only if a note from a parent/guardian or a medical excuse is provided. Anything missed due to an un-excused reason will result in a mark of zero.

- **Help Sessions** – Physics 20 is an extension of subject matter presented in Science 10. The concepts from the previous course are essential and will form the base for knowledge taught in Physics 20. **Extra help is available before school and during lunch on an appointment basis. Please make arrangements with me.**

- **Attitude** – Another necessity for this course is independence and accountability. You are responsible for keeping up with the homework, asking for help if needed, and studying for tests. This class is preparing you for post-secondary education, which requires all of these.

Evaluation:

Unit 1: Kinematics
Unit 2: Dynamics
Unit 3: Circular Motion, Work &Energy
Unit 4: Oscillatory Motion and mechanical Waves

Marking during the semester is on a cumulative basis. Classwork (homework, quizzes, labs, etc…) is worth 60% and tests are worth 40%. The overall value of the class work towards your finals grade is 45%.

Mid-Term Exam is worth 5%

Class Project is worth 10% (there may be more than on activity, this will be determined by the class as a whole early in the course)

Final Exam is worth 40%

Homework & assignments: this is the daily work assigned to students. Typically they are questions from their textbook, workbook or worksheets. These will be frequent and will vary in length and difficulty. Remember that not all of this work will be marked nor will every question be graded. If there are questions regarding anything that you see that is not taken up in class you are encouraged to come for help at lunch. The most important aspect of homework is the effort you put into completing it. If you rely too much on friends or forget to do it you will pay the price when it comes to individual tasks such as tests.

Quizzes and labs: quizzes are designed to test a small number of topics and are shorter than exams. The format for quizzes can vary from textbook style questions to paragraph responses to diploma exam style questions. Labs are activities that require some application of skill, research or attitude to complete. They can be in the form of thought, digital or hands on.

Unit tests: these tests will be similar to diploma exam in style, length and difficulty. Typically you will find 70% of the exam as multiple choice and numerical response and 30% written response.

Project: To be determined

Final Exam: this will be a cumulative exam, meaning it will cover the material from the whole course. Like unit exams they will be similar in style, length and difficulty of diploma exams.

Materials

The textbook for the course is Physics (Pearson). A scientific calculator (with log function) is also required for the course. Graph Paper. A data booklet will be supplied for the semester.

Teaching Techniques

The methods used for instruction will include lecture, question and answer discussion, small group work, individual tutorials, laboratory work and a variety of multi-media utilities.

If you have any questions with the information contained in this course outline, please contact me at the school.

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Mathematics and Science Directing Words

Discuss	The word "discuss" **will not** be used as a directing word on math and science diploma examinations because it is not used consistently to mean a single activity.

The following words are specific in meaning.

Algebraically	Using mathematical procedures that involve letters or symbols to represent numbers
Analyze	To make a mathematical, chemical, or methodical examination of parts to determine the nature, proportion, function, interrelationship, etc. of the whole
Compare	Examine the character or qualities of two things by providing characteristics of both that point out their *similarities* and *differences*
Conclude	State a logical end based on reasoning and/or evidence
Contrast/Distinguish	Point out the *differences* between two things that have similar or comparable natures
Criticize	Point out the *demerits* of an item or issue
Define	Provide the essential qualities or meaning of a word or concept; make distinct and clear by marking out the limits
Describe	Give a written account or represent the characteristics of something by a figure, model, or picture
Design/Plan	Construct a plan; i.e, a detailed sequence of actions for a specific purpose
Determine	Find a solution, to a specified degree of accuracy, to a problem by showing appropriate formulas, procedures, and calculations

Enumerate	Specify one by one or list in concise form and according to some order
Evaluate	Give the significance or worth of something by identifying the good and bad points or the advantages and disadvantages
Explain	Make clear what is not immediately obvious or entirely known; give the cause of or reason for; make known in detail
Graphically	Using a drawing that is produced electronically or by hand and that shows a relation between certain sets of numbers
How	Show in what manner or way, with what meaning
Hypothesize	Form a tentative proposition intended as a possible explanation for an observed phenomenon; i.e., a possible cause for a specific effect. The proposition should be testable logically and/or empirically
Identify	Recognize and select as having the characteristics of something
Illustrate	Make clear by giving an example. The form of the example must be specified in the question; i.e., word description, sketch, or diagram
Infer	Form a generalization from sample data; arrive at a conclusion by reasoning from evidence
Interpret	Tell the meaning of something; present information in a new form that adds meaning to the original data
Justify/Show How	Show reasons for or give facts that support a position
Model	Find a model (in mathematics, a model of a situation is a pattern that is supposed to represent or set a standard for a real situation) that does a good job of representing a situation
Outline	Give, in an organized fashion, the essential parts of something. The form of the outline must be

	specified in the question; i.e., list, flow chart, concept map
Predict	Tell in advance on the basis of empirical evidence and/or logic
Prove	Establish the truth or validity of a statement for the general case by giving factual evidence or logical argument
Relate	Show logical or causal connection between things
Sketch	Provide a drawing that represents the key features of an object or graph
Solve	Give a solution for a problem; i.e., explanation in words and/or numbers
Summarize	Give a brief account of the main points
Trace	Give a step-by-step description of the development
Verify	Establish, by substitution for a particular case or by geometric comparison, the truth of a statement
Why	Show the cause, reason, or purpose

Science Process Words

Hypothesis:	A single proposition intended as a possible explanation for an observed phenomenon; e.g., a possible cause for a specific effect
Conclusion:	A proposition that summarizes the extent to which a hypothesis and/or a theory has been supported or contradicted by the evidence
Experiment:	A set of manipulations and/or specific observations of nature that allow the testing of hypotheses and/or generalizations

Variables: Conditions that can change in an experiment. Variables in experiments are categorized as:

- *manipulated variables* (independent variables) —conditions that were deliberately changed by the experimenter
- *controlled variables* (fixed or restrained variables) — conditions that could have changed but did not, because of the intervention of the experimenter
- *responding variables* (dependent variables) —conditions that changed in response to the change in the manipulated variables

Technology: The development of our understanding of science is directly related to the development of technology. The meaning of technology has many facets, but in general, technology refers to a method or process for handling a specific practical problem. This includes the development of tools and new techniques for solving problems. It also includes ideas and their organization for achieving practical purposes. In the context of an examination question, technology includes both these facets of meaning. That is, a technological explanation should include not only identification and descriptions of equipment (tools, products) but also explanations of procedures.

Guidelines for Significant Digits, Manipulation of Data, and Rounding for Science Diploma Examinations

Significant Digits (measured values)

1. For all non-logarithmic values, regardless of decimal position, any of the digits 1 to 9 is a significant digit; 0 may be significant. For example:

   123 0.123 0.00230 2.30×10^3 2.03
   all have 3 significant digits

2. Leading zeros are not significant. For example:

   0.12 and 0.012 each have two significant digits

3. **The Learner Assessment Branch considers all trailing zeros to be significant**. For example:

   200 has three significant digits
   0.123 00 and 20.000 each have five significant digits

4. For logarithmic values such as pH, any digit to the left of the decimal is **not** significant. For example:

   a pH of 1.23 has two significant digits
   a pH of 7 has no significant digits

Manipulation of Data

1. When adding or subtracting measured quantities, the calculated answer should be rounded to the same degree of precision as that of the least precise number used in the computation **if this is the only operation**. For example in the following addition:

   12.3 (least precise)
   0.12
   12.34
   24.76

   The answer should be rounded to 24.8.

2. When multiplying or dividing measured quantities, the calculated answer should be rounded to the same number of significant digits as are contained in the quantity with the fewest number of significant digits **if this is the only operation**. For example:

   (1.23)(54.321) = 66.81483

   The answer should be rounded to 66.8.

3. When a series of calculations is performed, each interim value should not be rounded before carrying out the next calculation. The final answer should then be rounded to the same number of significant digits as are contained in the quantity in the **original data** with the fewest number of significant digits. For example:

   In determining the value of (1.23)(4.321) ÷ (3.45 – 3.21), three calculations are required:

   a. 3.45 – 3.21 = 0.24
   b. (1.23)(4.321) = 5.31483
   c. 5.31483 ÷ 0.24 = 22.145125
   [Not 5.31÷ 0.24 = 22.125]

   The value should be rounded to 22.1.

   Note: In the example given, steps *a* and *b* yield interim values. These values should not be used in determining the number of significant digits.

4. When calculations involve exact numbers (counted and defined values) the calculated answer should be rounded based upon the precision of the measured value(s). For example:

   12 eggs × 52.3 g/egg = 627.6 g
   or
   5 mol × 32.06 g/mol = 160.30 g
   or
   1 mol (–1 095.8 kJ/mol) + 2 mol (40.8 kJ/mol) = –1 014.2 kJ

Rounding

1. When the first digit to be dropped is less than or equal to 4, the last digit retained should not be changed. For example:

   1.2345 rounded to three digits is 1.23

2. When the first digit to be dropped is greater than or equal to 5, the last digit retained should be increased by one. For example:

   12.25 rounded to three digits is 12.3

Physics 20
A Brief Synopsis

Unit 1.

- ➔ *Describe motion in terms of displacement, velocity, acceleration and time.*

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses.

- ❖ scalar quantities
- ❖ vector quantities
- ❖ uniform motion
- ❖ uniformly accelerated motion
- ❖ two-dimensional motion

Unit 2.

- ➔ *Explain the effects of balanced and unbalanced forces on velocity*
- ➔ *Explain that gravitational effects extend throughout the universe.*

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses.

- ❖ Newton's laws of motion
- ❖ inertia
- ❖ vector addition
- ❖ static and kinetic friction
- ❖ gravitational force
- ❖ Newton's law of universal gravitation
- ❖ gravitational field

Unit 3.

- ➔ *Explain circular motion, using Newton's laws of motion*
- ➔ *Explain that work is a transfer of energy and that conservation of energy in an isolated system is a fundamental physical concept.*

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses.

- ❖ uniform circular motion
- ❖ conservation of mechanical energy
- ❖ planetary and satellite motion
- ❖ work-energy theorem
- ❖ Kepler's laws
- ❖ isolated systems
- ❖ mechanical energy
- ❖ power

Unit 4.

- ➔ *Describe the conditions that produce oscillatory motion*
- ➔ *Describe the properties of mechanical waves and explain how mechanical waves transmit energy.*

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses. • oscillatory motion

- ❖ simple harmonic motion
- ❖ restoring force
- ❖ oscillating spring, pendulum
- ❖ mechanical resonance
- ❖ mechanical waves—longitudinal and transverse
- ❖ universal wave equation
- ❖ reflection
- ❖ interference
- ❖ acoustic resonance
- ❖ Doppler effect