Course: Physics 12

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Course Description:

Physics 12 builds on students' understanding of motion, forces, and energy from Physics 11, as well as students' ability to apply mathematical reasoning to real life problems. In this course, students will design and conduct scientific experiments, perform numerical data collection and analysis, interpret and use graphs to model physical phenomena, and use their understanding of physics to solve novel problems. Additionally, there will be a research project to investigate current fields of research in modern physics and explore potential career paths in physics. Students will be expected to work both independently and in groups to complete course activities.

Summer Learning Beliefs:
Summer Learning provides an engaging learning environment where all students can challenge themselves and fulfill their learning goals. To ensure this, students will:

- abide by the student Code of Conduct
- adhere to the Academic Honesty Policy
- adhere to the Summer Learning Student Engagement policy
- respect themselves and others
- attend every class and be punctual
- inquire, think, and engage to the best of their ability
- access technology in class when instructed to do so and for learning purposes only
- challenge themselves and have fun learning

All Summer Learning policies can be accessed at:
https://www.sd44.ca/school/summer/policies/Pages/default.aspx#/=

Course Plan:

Unit	Essential Questions	Content	Curricular Competencies	Assessment Tasks
Relative Motion and Special Relativity	How can we describe relative motion in Newtonian physics? How does this compare with Einstein's theory of Special Relativity?	•Vector addition and subtraction •Frames of reference •Relative motion within an inertial reference frame •Postulates of Special Relativity •Relativistic effects within a moving reference frame (e.g. changes in time, length, mass)	**C -** Formulate physical or mental theoretical models to describe a phenomenon **EV -** Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled **PA -** Construct, analyze, and interpret graphs, models, and/or diagrams	•Conceptual questions •Group problem solving and peer grading of solutions •Summative test/quiz

Momentum and Collisions	How is the principle of conservation of linear momentum related to Newton's Laws of Motion? How can momentum conservation be used to predict the motion of objects involved in collisions?	•Conservation of linear momentum •Impulse •1D and 2D collisions •Ballistic pendulums •Rocket propulsion	**QP** - Formulate multiple hypotheses and predict multiple outcomes **PC** - Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative) **PC** - Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data **E -** Describe specific ways to improve their investigation methods and the quality of their data	•Conceptual questions •Group problem solving and peer grading of solutions •Collision lab •Summative test/quiz
Static Equilibrium	How does the position of an applied force relative to an object's centre of mass affect its motion? What conditions must be true for a system to remain in static equilibrium?	•Torque •Location of centre of mass of a uniform body •Translational equilibrium: sum of all forces equals zero •Rotational equilibrium: sum of all torques equals zero	**PC** - Apply the concepts of accuracy and precision to experimental procedures and data: significant figures uncertainty scientific notation **PA** - Use knowledge of scientific concepts to draw conclusions that are consistent with evidence **E** - Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions	•Conceptual questions •Group problem solving and peer grading of solutions •Statics lab •Summative test/quiz

Uniform Circular Motion and Gravitation	Under what conditions do forces cause circular as opposed to linear motion? How can circular motion affect our perception of our weight (apparent weight)? How can the concepts of gravitational field and gravitational potential energy help us to describe and predict orbital motion?	•Centripetal force and acceleration •Changes to apparent weight, artificial gravity •Newton's Universal Law of Gravitation •Gravitational field •Gravitational potential energy •Satellite motion, orbit changes, launch velocity, escape velocity	**PA** - Analyze cause-and-effect relationships **PA** - Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies **E** - Consider the changes in knowledge over time as tools and technologies have developed **C** - Communicate scientific ideas and information	•Conceptual questions •Group problem solving and peer grading of solutions •Circular motion lab •Assignment: designing artificial gravity for a space station •Summative test/quiz
Electricity and Magnetism	How can we describe electrostatic force? How does an electric field differ from a gravitational field? How can we visualize a magnetic field? How are electric and magnetic fields interconnected?	•Coulomb's Law •Electric field •Electric potential energy and electric potential •Electrostatics and energy relationships for a point charge: -1D and 2D with other charges -In orbits -Between parallel plates •Magnetic field produced by: -permanent magnets -straight wires -solenoids •Lorentz force on a moving charge or current carrying wire in a magnetic field •Electromagnetic induction: -Faraday's Law -Lenz's Law -Applications (DC motors, generators, transformers)	**QP** - Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world **PA** - Use knowledge of scientific concepts to draw conclusions that are consistent with evidence **AI** - Implement multiple strategies to solve problems in real-life, applied, and conceptual situations **E** - Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems	•Conceptual questions •Group problem solving and peer grading of solutions •Assignment: Applications of electromagnetic induction •Summative test/quiz

Modern Physics and Careers in Physics	What topics do physicists study today?	•Student-led research and inquiry	**QP** - Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest **AI** - Consider the role of scientists in innovation **E** - Connect scientific explorations to careers in science	•Student-led research project •Celebration of learning presentation

Grade Descriptors:

"A" quality evidence of learning….
Produces high-quality, frequently innovative work. Communicates scientific ideas to connect and synthesize concepts and skills learned over time. Consistently demonstrates sophisticated critical and creative thinking. Collects, presents, and correctly transforms experimental data. Interprets, analyzes and critiques scientific findings and experimental data. Frequently transfers and extends knowledge and skills and uses concepts to solve non-routine, real-world problems, displaying initiative and expertise in their approach. Virtually no support is needed. Mistakes made are not reflective of gaps or deficiencies in mastery.

"B" quality evidence of learning….
Sometimes produces high-quality, innovative work. Communicates scientific ideas to compare and critique concepts and skills learned over time. Consistently demonstrates a degree of critical and creative thinking. Collects and presents scientific data in an appropriate manner. Assesses, interprets, and revises scientific findings and experimental data. Transfers knowledge and skills and uses concepts to consistently solve routine, real-world problems correctly with minimal guidance and occasional periods of greater support, with some mistakes sometimes indicative of gaps in mastery.

"C" quality evidence of learning….
Produces work of an acceptable and inconsistent quality. Communicates a basic understanding of scientific concepts and operates superficially within a scientific contextual framework. Displays an emergent level of application when it comes to critical thinking skills. Collects scientific data in an appropriate manner. Is inflexible in the use of knowledge and skills, requiring moderate to high levels of support even in familiar classroom situations. Makes attempts to use knowledge, skills and scientific concepts to solve routine, real-world problems, with frequent mistakes indicative of gaps in mastery.

Resources:
Online Textbook: https://openstax.org/books/college-physics/pages/preface
Other materials, worksheets, review problems, assignments, and labs will be posted on MS Teams

We would like to thank the Coast Salish people, specifically the Skwxwú7mesh Nation and Tsleil-Waututh Nation, on whose unceded traditional territory the North Vancouver School District resides. We value the opportunity to learn, share and grow on this traditional territory.