Shanghai Nanyang Model Private School

(BC OFFSHORE PROGRAM)

PHYSICS 12 Annual Plan

2025–2026

Link to Curriculum: https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/curriculum/science/en_science_12_physics_elab.pdf

Course Synopsis

The course starts from where Physics 11 left off with the study of motion. Students will explore dynamics, circular motion, energy, electricity and magnetism. The course requires a strong foundation in mathematics. The course emphasizes problem-solving and exploration.

Big Ideas

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Measurement of motion depends on our frame of reference.	Forces can cause linear and circular motion.	Forces and energy interactions occur within fields.	Momentum is conserved within a closed and isolated system.

Competencies & Content

Core Competencies	Curricular Competencies	Content
Communication ▸ Connect and engage with others ▸ Acquire, interpret, and present information ▸ Collaborate to plan, carry out, and review activities ▸ Explain/recount and reflect on experiences **Creative Thinking** ▸ Novelty and value ▸ Generating ideas ▸ Developing ideas **Critical Thinking** ▸ Analyze and critique ▸ Question and investigate ▸ Develop and design **Personal & Cultural Identity** ▸ Relationship and cultural contexts ▸ Personal values and choice ▸ Personal strengths and abilities **Personal Awareness & Responsibility** ▸ Self-determination ▸ Self-regulation ▸ Well-being **Social Responsibility** ▸ Contributing to community ▸ Solving problems peacefully ▸ Valuing diversity ▸ Building relationships	**Questioning and predicting** ▸ Demonstrate sustained intellectual curiosity ▸ Make observations to identify questions ▸ Formulate multiple hypotheses **Planning and conducting** ▸ Plan and use appropriate investigation methods ▸ Assess risks and address ethical issues ▸ Use appropriate SI units and equipment ▸ Apply accuracy and precision concepts **Processing and analyzing** ▸ Experience and interpret local environment ▸ Apply First Peoples perspectives ▸ Seek patterns, trends, and connections ▸ Construct, analyze, and interpret graphs ▸ Draw evidence-based conclusions ▸ Analyze cause-and-effect relationships **Evaluating** ▸ Evaluate methods and identify sources of error ▸ Describe ways to improve investigations ▸ Evaluate validity and limitations of models ▸ Demonstrate awareness of assumptions and bias ▸ Connect scientific explorations to careers **Applying and innovating** ▸ Contribute to care for self, others, community ▸ Transfer and apply learning to new situations ▸ Generate new ideas when problem solving **Communicating** ▸ Formulate theoretical models ▸ Communicate scientific ideas with evidence ▸ Reflect on experiences and worldviews	**Students are expected to know:** ▸ Frames of reference ▸ Relative motion within a stationary reference frame ▸ Postulates of special relativity ▸ Relativistic effects within a moving reference frame ▸ Static equilibrium ▸ Uniform circular motion: centripetal force and acceleration ▸ Changes to apparent weight ▸ First Peoples knowledge and applications of forces ▸ Gravitational field and Newton's law of universal gravitation ▸ Gravitational potential energy ▸ Gravitational dynamics and energy relationships ▸ Electric field and Coulomb's law ▸ Electric potential energy, potential, and potential difference ▸ Electrostatic dynamics and energy relationships ▸ Magnetic field and magnetic force ▸ Electromagnetic induction ▸ Applications of electromagnetic induction ▸ Impulse and momentum ▸ Conservation of momentum and energy in collisions ▸ Graphical methods in physics

English Language Strategies, Indigenous Learning, Timeline

English Language Strategies	▸ Vocabulary words highlighted and practiced ▸ Assessments include vocabulary and language components ▸ Large projects scaffolded with checkpoints ▸ Oral speaking through discussions, think-pair-share, group work ▸ Materials supported by high quality visuals ▸ Lecture notes (animated PowerPoints) available online ▸ Foster open and safe environment for speaking
Indigenous Learning	▸ First People's principles embedded throughout course ▸ Learning process: holistic, reflexive, reflective, experiential, relational ▸ Focused on connectedness, reciprocal relationships, sense of place ▸ Learning involves patience and time; learning is different for everyone

Timeline

Unit	Title	Month
1	Introduction to Physics and Kinematics	September
2	Dynamics: Forces and Newton's Laws	October
3	Work, Energy and Power	November
4	Momentum and Conservation Laws	December
5	Circular Motion and Gravitation	February
6	Electrostatics and Electric Fields	March
7	Electric Circuits and Electromotive Force	April
8	Magnetism and Electromagnetic Induction	May
9	Special Relativity	June

Summary of Assessment

Formative Assessments	Self Evaluations	Summative Assessments
▸ Circulating during conceptual questions ▸ Gauging needs based on common homework questions ▸ Verbal checks for understanding ▸ Vocabulary: classroom challenge questions ▸ Homework checks as needed ▸ Demos/conversations	▸ During lectures: students try questions before teacher ▸ Answer keys for pre-tests and tests for self-corrections ▸ Core competency self reflections	▸ Unit tests ▸ Midterm and Final Exams ▸ Student submissions for activities and projects ▸ Labs

Assessment Weighting

Category	Weight
Quizzes	15%
Unit Tests	30%
Labs and Activities	15%
Homework	10%
Midterm	10%
Final Exam	20%

Unit Overviews

Unit 1: Kinematics

Big Idea(s)	Core Competencies	Content	Activities
How can uniform motion and uniform acceleration be modelled? When are measurements considered to be relative? How is vector addition different from scalar addition?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Design experiment to plot distance vs height **Critical Thinking:** Limits of scientific models	**Vector/scalar:** - Addition and subtraction - Right-angle triangle **Uniform/accelerated motion:** - Graphical and quantitative **Projectile motion:** - Vertical, horizontal, angled launch	**Assessments:** Quiz, unit tests, project, lab **ESL:** Review vocabulary **Indigenous:** As outlined above **Lab:** Water balloon launcher

Unit 2: Newton's Laws

Big Idea(s)	Core Competencies	Content	Activities
How can forces change motion? How can Newton's laws explain changes in motion?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Design water balloon launch experiment **Critical Thinking:** Consider alternative approaches	**Contact forces:** normal, spring, tension, friction **Newton's laws of motion** **Forces in systems:** - One-body and multi-body systems - Inclined planes - Angled forces - Elevators	**Assessments:** Quiz, unit tests, project **ESL:** Review vocabulary **Indigenous:** As outlined above **Lab:** Elevator acceleration experiment with scale

Unit 3: Equilibrium

Big Idea(s)	Core Competencies	Content	Activities
When is an object in equilibrium? What are the implications for building structures?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Design experiment to plot distance vs height **Critical Thinking:** Limits of scientific models	**Static equilibrium:** - Translational: sum of all forces equals zero (vertical and horizontal) - Rotational: sum of all torques equals zero, location of centre of gravity of a uniform body	**Assessments:** Quiz, unit tests, project, lab **ESL:** Review Grade 10 vocabulary **Indigenous:** As outlined above **Lab:** Torque lab

Unit 4: Uniform Circular Motion

Big Idea(s)	Core Competencies	Content	Activities
Why do you feel a sideways sliding motion when you speed around a corner? Why must the "orbiting electron" model of the atom be false?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Design a pendulum experiment **Critical Thinking:** Limits of scientific models	**Uniform circular motion:** both horizontal and vertical circles **Changes to apparent weight:** vertical and horizontal circles	**Assessments:** Quiz, unit tests, projects **ESL:** Review vocabulary **Indigenous:** As outlined above **Lab:** Pendulum Lab

Unit 5: Fields and Forces

Big Idea(s)	Core Competencies	Content	Activities
Why is gravity considered a fundamental force? Explain similarities and differences between electrostatic and gravitational force. How are electric fields similar to magnetic and gravitational fields? What is the relationship between the moon orbiting Earth and an apple falling?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Build skills to make ideas work **Critical Thinking:** Consider alternative approaches	**Gravitational field:** - Vector field, interacts with mass - Attractive only - Gravitational dynamics: satellite motion, orbits, escape velocity **Electric field:** - Vector field, interacts with charge - Attractive or repulsive - Point charges and parallel plates **Magnetic field:** - Induced by moving charges - Permanent magnets, wires, solenoids **Magnetic force:** - On moving charge or current-carrying wire - Right-hand rules	**Assessments:** Quiz, unit test, project **ESL:** Review vocabulary **Indigenous:** As outlined above **Activity:** 7E Phases for Science Fair topics

Unit 6: Energy in Fields and Interactions

Big Idea(s)	Core Competencies	Content	Activities
How can a conductor and a magnet be used to generate electricity? How are electric fields similar to gravitational fields?	**Communication:** Lab report writing **Personal Awareness:** Set realistic goals, persevere **Creativity:** Build skills to make ideas work **Critical Thinking:** Consider alternative approaches	**Gravitational dynamics:** satellite motion, orbit changes, launch/escape velocity **Electrostatic dynamics:** - Force, charge, distance relationships - 1D and 2D with other charges - In orbits, between parallel plates - Conservation of energy applications (CRT, mass spectrometer, particle accelerator) **Electromagnetic induction:** - Faraday's law, Lenz's law - Current induced by changing magnetic flux **Applications:** back EMF, DC motors, generators, transformers	**Assessments:** Quizzes, unit test, Electricity Lab **ESL:** Review vocabulary **Indigenous:** As outlined above **Activity:** 7E Phases for Science Fair

Unit 8: Special Relativity

Big Idea(s)	Core Competencies	Content	Activities
What are the implications of the theory of special relativity?	**Communication:** Research project **Personal Awareness:** Set realistic goals, persevere **Creativity:** Build skills to make ideas work **Critical Thinking:** Consider alternative approaches	**Relativistic effects:** - Changes in time - Changes in length - Changes in mass	**Assessments:** Quiz, unit tests **ESL:** Review Grade 10 vocabulary **Indigenous:** As outlined above **Activity:** Research project