Salesian International School 2025 Module Rubric

Year	10	Course	Science Year 10	Credits	
Module Title	Integrated Science: Science Skills Mastery (Grade 10) Physics				

Course Summary

This physics course is designed to explore physical phenomena through a mathematically grounded approach. The course emphasizes using mathematical reasoning to help students better understand physical concepts and to develop critical thinking and scientific reasoning skills. Students will study key topics in classical mechanics, including motion, forces, energy conservation, thermodynamics, electricity, and everyday physical applications.
Alongside foundational content, students will explore required topics in modern physics, including electromagnetism, quantum mechanics, relativistic mechanics, and quantum field theory. These areas will be linked to current and future-facing technologies such as quantum computing, blackbody radiation, quantum optics, tunneling, and exciton-based systems.

Note: In response to the rapid pace of change in physics and technology, course topics may be updated as needed. New content may be added—or existing content refined—to reflect emerging trends, particularly in the growing convergence of artificial intelligence (AI) and quantum science. However, the core physical principles, mathematical reasoning skills, and scientific thinking practices will be consistently and thoroughly developed.

This course is indeed designed to train students to solve complex problems that are appropriately challenging for the secondary school level. While not all students are expected to engage in engineering-level or research-grade problem solving, gifted students or those seeking further challenge will have the option to pursue deeper, open-ended investigations reflecting real-world physics and cutting-edge technology applications.
Experiments will primarily be conducted through digital simulations and programming environments, using tools such as Python or other platforms that allow students to build, test, and analyze physical models virtually. A strong preference is placed on virtual experimentation, enabling creative and accessible exploration of physics concepts.
All assignments—including lab reports and project work—must be submitted digitally via Google Classroom and should include appropriate references or citations.

This course is designed to equip students for the digital and quantum age by helping them build a solid foundation in physics, explore real-world applications, and develop the analytical and conceptual thinking skills needed in a technology-driven world.

Required Materials

- Pearson Science 10, 2nd Edition (eBook)
- iPad or digital device with internet access
- Digital tools and virtual simulation apps:

•PhET Interactive Simulations: Free, interactive simulations for physics, chemistry, biology, and mathematics. Ideal for visualizing core concepts like motion and energy.
•Pivot Interactives: Customizable, video-based virtual labs with real-world data collection. Free trials available.
•Labster: 3D virtual lab simulations with immersive scenarios in motion, energy, and advanced physics. Requires an educational license for full access.

- Student-developed simulations (optional):

Students are encouraged to build their own simulation environments or experimental models using coding platforms. Python is highly recommended, but other programming languages are also acceptable based on student preference. These student-created tools can be used to demonstrate and explore physics concepts independently or as part of project-based learning.

Assessment Basis

Creative Thinking	A3 Students will demonstrate deep understanding of fundamental physics concepts, including classical mechanics, thermodynamics, electromagnetism, and quantum theory. They will explain physical laws using appropriate terminology and mathematical notation, and interpret key ideas in modern and cutting-edge contexts. This includes recognizing how current technologies (such as AI, quantum computing, and digital automation) are grounded in physical principles. Students will explore the evolution and relevance of physics knowledge in today's rapidly advancing scientific and technological landscape.This level is not limited to memorization—it fosters conceptual fluency and the ability to explain "why" and "how" physics connects to both natural phenomena and	B3 Students will apply their knowledge by designing and modeling physical systems through experimental planning, data analysis, and virtual simulation. They will build and test models—digitally or through code (e.g. Python)—to explore dynamic systems like motion, forces, energy, or quantum behaviors. Students are encouraged to communicate scientific ideas using visuals, code, animations, or simulations. Emphasis will be placed on the clarity, relevance, and innovation of the models they develop to reflect real-world or future-based scenarios. Application is not just lab execution—students are creators of learning tools and simulations that reflect the AI-enhanced future of physics.	C3 Students will critically evaluate physical systems and propose original solutions or conceptual frameworks for emerging scientific challenges. They will investigate the role of physics in shaping AI, quantum technologies, and other future-oriented innovations. Emphasis will be placed on the ability to question assumptions, identify limitations of current models, and propose creative alternatives supported by conceptual reasoning and mathematical logic. Students will reflect on the societal and ethical implications of scientific advancement, such as sustainability, digital responsibility, and quantum-era security. They are expected to demonstrate thoughtful judgment by connecting physics theory to rapidly evolving global needs and technology landscapes.
Critical Thinking	A2 Students will explain relationships in experimental findings and how systems interact to produce outcomes. They will examine how physical systems—such as electrical circuits or force-motion interactions—connect with real-world observations. Students will be able to describe the implications of scientific investigations and recognize ethical and environmental factors that influence outcomes. They will articulate how different variables contribute to physical change and use physics reasoning to explain observed patterns.	B2 Students will evaluate experimental data and identify patterns, outliers, or inconsistencies. They will assess how experimental design choices (e.g., control of variables or measurement techniques) influence the reliability and validity of findings. Students will apply reasoning to propose plausible interpretations and explore alternate explanations for results. Emphasis is placed on clarity, accuracy, and relevance of analysis, especially in real-world or simulated contexts (e.g., digital lab tools, coding-based investigations).	C2 Students will critically assess models, simulations, or experiments to identify limitations, assumptions, and possible sources of error. They will evaluate the effectiveness of scientific methods in addressing complex or emerging physics problems, especially where technological or societal impacts are involved. Emphasis will be placed on the ability to synthesize findings, question conclusions, and propose refinements or ethical considerations in the design and application of physics-based solutions.
Logical Thinking	A1 Students will demonstrate understanding of logical reasoning in science by identifying cause-and-effect relationships in physics systems. They will recognize consistent patterns, use appropriate mathematical equations (e.g., Newton's laws, Ohm's law, energy formulas), and follow structured steps in calculations. Emphasis is placed on drawing valid inferences from data, interpreting graphs or models logically, and justifying answers based on physical laws and evidence. Students will learn to construct logical arguments and identify flawed reasoning in everyday or simulated contexts.	B1 Students will apply logical thinking to solve multistep problems in physics, using evidence and formulas to justify each step. They will compare results from theoretical calculations with experimental outcomes, identifying discrepancies and providing reasoned explanations. Students will use decision-making strategies to evaluate options in simulations or design investigations. Emphasis will be placed on the ability to follow a clear problem-solving structure, validate assumptions, and present logically consistent arguments across mechanics, thermodynamics, and electromagnetism topics.	C1 Students will evaluate the logical consistency of scientific models, arguments, or theories in both classical and modern physics contexts. They will identify limitations, contradictions, or oversights in reasoning, especially in cutting-edge topics such as quantum circuits or field models. Students will construct and critique logic chains, using both symbolic and conceptual reasoning. Emphasis is placed on advanced synthesis: applying logic across systems, connecting diverse physical principles, and evaluating how well conclusions follow from data and assumptions in complex or novel situations.
	Basics (Knowledge)	**Development/Communication (Application)**	**Judgment (Inquiry)**

Course Contents/Topics

Term 1

Core Scientific Inquiry Skills
Understand and apply the classical stages of scientific inquiry (question, hypothesis, variables, method, data, analysis, conclusion).
Develop skills to plan, design, simulate, and execute investigations in fully virtual or code-based environments.
Propose original investigation topics and experimental methods, supported by logical design and relevant physical principles.
Design and customize the entire experimental workflow, including:
– Setting up digital environments or simulations (e.g., PhET, Pivot, Labster, or custom Python-based tools)
– Selecting or generating appropriate data (either self-produced or obtained from verified scientific datasets)
– Defining parameters, controls, and variables relevant to the investigation.
Apply analytical tools (graphs, models, code-generated visuals) to interpret and evaluate results.
Communicate findings through clear documentation, data representation, and reflective insights on experimental validity and improvement.
Students are not merely executing labs—they are the designers and implementers of scientific research in a digital setting. The goal is to foster autonomy, creativity, and problem-solving through inquiry grounded in physics.

Classical Mechanics: Motion and Energy (Chapter 9)
9.1 Describing motion
9.1 Practical investigations and review questions
9.2 Changes in speed
9.2 Practical investigations and review questions
9.3 Newton's laws of motion
9.3 Practical investigations and review questions
9.4 Energy changes
Application to real-world scenarios through virtual simulations and model-based analysis.

Modern/Quantum Physics Introduction
Chapter 13.1: The atom
Understanding atomic models and quantum behavior of particles
Practical simulations or coding activities modeling particle states (using Python or other tools)
Link to quantum computing and AI applications (e.g., quantum bits, tunneling, particle spin models)
Explore the significance of quantum principles in current and emerging technologies

Term 2

Thermodynamics & Quantum Field Connections
Chapter 13.2: Thermodynamics – Study of heat and energy transfer
Link thermal energy transfer to quantum ideas such as blackbody radiation
Discuss quantization of energy and its role in field theory
Explore how quantum field theory explains phenomena at subatomic levels, even in high school-relevant contexts

Electricity & Quantum Circuit Introduction
Chapter 13.4: Basic principles of electric circuits
Ohm's Law, voltage, current, resistance
Series and parallel circuits
Electromagnetic relationships (e.g., Faraday's Law)
Energy and power in electric systems

Quantum Extensions
Understand classical vs. quantum bits (qubits)
Build simple quantum circuits (e.g., Pauli-X, Hadamard gate)
Explore quantum gates and their mathematical logic
Relate quantum gates to basic quantum logic operations
Connect to real-world uses: quantum computing and encryption

Astronomy, Fields & Quantum Field Theory Perspectives
Chapter 13.5: Earth and the Universe – Astronomy and Planetary Motion
Explore gravitational and magnetic fields as they apply to planetary motion, tides, and space phenomena.
Understand the Earth's magnetic field and its interaction with solar wind (e.g., auroras).
Analyze non-contact forces in space and their observable effects.

Relativity & Subatomic Particles
Introduce Einstein's theory of relativity in real-world applications (e.g., GPS).
Investigate time dilation through muon decay experiments in the atmosphere.
Relate to foundational ideas in spacetime, velocity, and energy.

Light and the Electromagnetic Spectrum
Understand wave-particle duality through light interference and the photoelectric effect.
Learn how energy and frequency relate to photon behavior using Planck's equation.
Explore electromagnetic radiation, visible light, and their technological and health-related applications.

Link to Quantum Field Theory (QFT)
Bridge classical electromagnetic theory with quantum principles by linking light behavior to quantization of energy.
Use thermal radiation and blackbody radiation to introduce QFT's treatment of particles as quantized fields.
Highlight how wave-particle duality and photon energy concepts are essential for understanding fields at a subatomic level.

Term 3

Advanced Applications of Core Concepts
Revisit and consolidate Term 1 and Term 2 topics with an emphasis on mastering fundamental physics principles.
Apply core concepts from classical, quantum, and modern physics in more complex, interdisciplinary scenarios to enhance critical thinking and synthesis skills.

Independent Research Project
Select a contemporary or emerging topic in physics of personal interest.
Design and execute a unique project that demonstrates independent thinking, analytical ability, and creativity in a scientific context, using the inquiry skills and conceptual knowledge developed throughout the course.

Modes of Assessment

Formative & Summative Assessments

Formative Assessments
Categories: Problem-solving Test (Pass/Fail — prerequisite for all other assessments); Project Submission/Presentation; Mini Research Paper
Content: Chapter-based concepts and content (varies depending on class focus)
Submission method: All submissions should be digital (via Google Classroom)

Summative Assessments
Categories: Same as formative — Problem-solving Test (Pass/Fail — prerequisite for all other assessments); Project Submission/Presentation; Mini Research Paper
Format: Oral Testing (online — synchronous or video taping)
Content: Chapter-based concepts and content (specific topics may vary according to recent class activities and real-time developments in physics)

Note: For detailed formats and expectations, refer to the syllabus.