Science **Brunswick School Department**

Physics: Honors

Rotational Motion

Essential Understandings	▪ Conceptual: o The reoccurring fundamental principles elaborated in physics have uses and implications in every dimension of modern life. o Physics seeks to analyze and understand every system as a demonstration of the cause-effect relationship. ▪ Computational: o Physics quantifies each variable of a system in order to describe, analyze and understand it. o A variety of problem solving techniques make use of a system's quantities to investigate the conceptual relationships evidenced within the system. o Numerical problem solving is an essential component in developing a clear understanding of the conceptual relationships identified within any system.
Essential Questions	▪ How does rotational motion compare and contrast to linear motion? ▪ How does torque affect angular acceleration? ▪ How is angular momentum conserved and how can the moment of inertia help to calculate momentum? ▪ How is rotational kinetic energy conserved? ▪ What are the characteristics of the center of mass of a system? ▪ How does the work-energy theorem relate to rotational systems?
Essential Knowledge	▪ Linear and angular formulas are analogous. ▪ Rotating bodies have both angular velocity and tangential speed. ▪ Moment of inertia is the ease with which an object can rotationally accelerate. ▪ Rotating bodies have rotational kinetic energy. ▪ Newton's Second Law also applies to rotating systems. ▪ When torque on a system is not balanced, the system will rotationally accelerate.
Vocabulary	▪ Terms: o angular position, angular velocity, angular acceleration, centripetal acceleration, tangential velocity, moment of inertial, rotational kinetic energy, torque, static equilibrium, angular momentum, rotational work

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Essential Skills	▪ Calculate angular displacement, angular velocity and angular acceleration of a body or system of bodies. ▪ Use static equilibrium to analyze systems with shape and multiple forces. ▪ Resolve force vectors to sum forces and torques in various directions. ▪ Understand the vector nature of rotational motion. ▪ Calculate the center of mass of a system.
Related Maine Learning Results	<u>Science and Technology</u> A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system. B. The Skills and Traits of Scientific Inquiry and Technological Design B2.Skills and Traits of Technological Design Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or product that meets new needs or improves existing designs. a. Identify new problems or a current design in need of improvement b. Generate alternative design solutions. c. Select the design that best meets established criteria. d. Use models and simulations as prototypes in the design planning process. e. Implement the proposed design solution. f. Evaluate the solution to a design problem and the consequences of that solution. g. Present the problem, design, process, and solution to a design problem including models, diagrams, and demonstrations.

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Related Maine Learning Results	D. The Physical Setting D3.Matter and Energy Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy. i. Explain the relations between kinetic and potential energy and apply the knowledge to solve problems. j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibrations) useful energy is often lost through radiation or conduction. D4.Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation.
Sample Lessons And Activities	▪ Read the text book and complete the examples presented. ▪ Individually answer conceptual questions and solve problems. ▪ Collectively discuss the answers and solutions in class. ▪ Discuss real world examples of concepts presented in the textbook and encountered in the real world. ▪ Design, construct and test mouse trap cars.
Sample Classroom Assessment Methods	▪ Evaluate homework assignments. ▪ Assess understanding in classroom discussions. ▪ Grade and discuss laboratory reports. ▪ Evaluate written formative and summative assessments with real world conceptual questions and numerical problems.
Sample Resources	▪ Publications: o Physics Second Edition - James S. Walker ▪ Videos: o Mechanical Universe Video Series ▪ Other Resources: o Companion Website: http://physics.prenhall.com/walker o Physics Demonstrations in Mechanics o Pasco's Data Studio program

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