

Wright City Science Curriculum

(4th Grade)

Grade	4th Grade
Unit of Study	Force and Motion
Length of Unit	30 Days(30 mins/day)
Sample Essential Questions	Sample Corresponding Big Ideas
- How is the speed of an object related to the amount of energy it possesses? - Does a faster object always have more energy than a slower one?	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (A.1)
- How can we tell that energy has transferred from one form (like motion) to another (like sound or heat)? - What evidence shows that energy is moving from place to place? - How can we design a device that converts energy from one form to another to solve a specific problem? - What constraints (like materials or cost) must be considered when building an energy-converting device?	PS3.B: Conservation of Energy and Energy Transfer Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (B.1), (B.2)
- How do balanced and unbalanced forces affect an object differently? - What happens to an object at rest when an unbalanced force acts on it?	PS2.A: Forces and Motion Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (A.2)
What evidence do we need to prove that motion follows a pattern?	The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (A.1)

• How does the texture of a surface affect the amount of force needed to move an object? • Why is it harder to slide an object over some surfaces than others? • How does changing the mass of an object change how it moves when pushed? • What is the relationship between the strength of a force and the speed or direction of an object?	PS2.B: Types of Interactions • The effect of unbalanced forces on an object results in a change of motion. Patterns of motion can be used to predict future motion. Some forces act through contact; some forces act even when the objects are not in contact. The gravitational force of Earth acting on an object near Earth's surface pulls that object toward Earth's center. (B.1) (B.2)
• How do simple machines change the amount of force or direction needed to do work? • Why do we use machines to help us move heavy objects?	PS3.C: Relationship Between Energy and Forces • A simple machine can change the amount of force or distance necessary to do work. (C.1)
	PS3.D: Energy in Chemical Processes and Everyday Life • The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (B.2)
• How do the available materials limit our ability to solve a challenge? • How do we determine if a prototype is successful based on the required features? • How do we identify physical constraints for our prototypes? • How does testing a portion of the prototypes help us predict how it will work as a whole? • How can we compare different designs to see which are the most successful?	ETS1.A: Defining Engineering Problems • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to B.2) ETS1.B: Developing Possible Solutions • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (B.1) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (B.1) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (C.1) ETS1.C: Optimizing the Design Solution • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (C.1)

Priority Standards	Supporting Standards
4.PS3.A.1 -Use evidence to construct an explanation relating the speed of an object to the energy of that object.	
4.PS2.B.2 Predict how changes in either the amount of force applied to an object or the mass of the object affects the motion (speed and direction) of the object	4.PS2.A.1 -Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. 4.PS2.B.1 -Plan and conduct a fair test to compare and contrast the forces (measured by a spring scale in Newtons) required to overcome friction when an object moves over different surfaces (i.e. rough/smooth)
4.PS3.A.1 -Use evidence to construct an explanation relating the speed of an object to the energy of that object.	4.ETS1.A.1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost 4.ETS1.B.1 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem 4.ETS1.C.1 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
4.PS3.C.1 -Use models to explain that simple machines change the amount of effort force and/or direction of force	

Unit 1 Sequence			
MLS	Topic(s)	Learning Targets	Academic Vocabulary
4.PS3.A.1	Force and Motion	I can explain the relationship between speed and energy. I can use evidence to prove that the faster an object moves, the more energy it has.	force motion position
4.PS2.B2	Force, Mass, and Motion	I can predict what happens to an object's speed or direction when I change the amount of force used. I can predict how the mass (weight) of an object affects how it moves. I can observe an object moving to find a pattern.	mass predict observe gravity

		I can use patterns in past motion to predict where an object will go next.	attract repel
4.PS2.B1	Friction and Measurement	I can plan a "fair test" to compare how hard it is to move an object over different surfaces. I can use a spring scale to measure force in Newtons. I can explain how rough and smooth surfaces affect friction.	friction surface inertia potential energy kinetic energy
4.PS3.C.1	Simple Machines	I can use a model to show how simple machines make work easier. I can explain how a machine (like a lever or pulley) changes the direction of a force. I can explain how a machine changes the amount of force needed to move an object.	lever wheel & axle pulley inclined plane wedge screw compound machine
4.ETS1.A.1, 4.ETS1.B.1, 4.ETS1.C.1	Engineering Design	I can define a design problem by identifying the criteria (what it must do) and constraints (limits like time or money). I can brainstorm multiple solutions and compare them to see which one works best. I can carry out a fair test to find "failure points" in my model. I can use data from my tests to improve my design.	design constraint failure points

MLS	Learning Activities	
4.PS3.A.1	Forces, Net Force, and Motion Basics	Must Do ▾
4.PS2.B2/B1	Speed Friction, and Gravity	Must Do ▾
4.ETS1.A.1, 4.ETS1.B.1, 4.ETS1.C.1	Energy, Collisions, & Roller Coaster Challenge	Must Do ▾
4.PS3.C.1	Simple machines stations	Diff Inst ▾

Assessments		
MLS	Description or Location	Rubric/Location

4.PS2.B2	Students must design a model that allows a marble to successfully complete a loop without extra force being applied to it. They must then create their models, test and modify as needed.	Marble Rollercoaster Rubric
4.ETS1.A.1, 4.ETS1.B.1, 4.ETS1.C.1	Have students develop a model including simple machines to solve a known issue. (example- on our playground)	Simple machine rubric

Additional Resources	
• Teacher Slides	
• Student Guided notes	
• Materials	