Motion & Forces (MF)

Middle School –Grade 8

Texts to be used: McDougal Littell& *Unit Resource Book (URB) where noted	Motion Forces (MF)

RI Statements of Enduring Knowledge - (Established Goals):

ESS2 The earth is part of a solar system, made up of distinct parts that have temporal and spatial interrelationships.

PS2 Energy is necessary for change in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS3 The motion of an object is affected by forces.

Related Rhode Island GSE's (Understandings)	**RI Assessment Targets** Assessment Evidence

ESS2 (7-8) -8
Students demonstrate an understanding of gravitational relationships between or among objects of the solar system by…
 	
8d describing the relationship between mass and the gravitational force between objects.
 	
8e describing the relationship between distance and the gravitational force between objects.
 	
8f explaining that the sun's gravitational pull holds the Earth and other planets in their orbits, just as the planet's gravitational pull keeps their moons in orbit.
 	
ESS2 (5-6)-8
Students demonstrate an understanding of gravitational relationships between or among objects of the solar system by..
8d defining the Earth's gravity as a force that p[ulls any object on or near the Earth toward its center without touching it.
	ESS2 (5-8) MAS –6
	Compare and contrast planets based on data provided about size, composition, location, orbital movement, atmosphere, or surface features (includes moons).
	• Orbits discussion p.81 **(MF)**
	• P.80 Discussion & Reading "Gravity keeps objects in orbit." **(MF)**
	  • Orbits Transparency T22 in Unit Transparency Book; Class Discussion **(MF)**
	• **Connect this content to what was learned specifically in grade 6, Space Science.
	PS2 (5-8) –SAE + POC–6
	Given a real-world example, show that within a system, energy transforms from one form to another (i.e., chemical, heat, electrical, gravitational, light, sound, mechanical).
	  • Reference Chapter 4.0 -4.2 pp.112-129 **(MF)**
	  • Investigation: "How do you work?" P.115
	  • Investigation:"How much work does it take?" P.118 **(MF)**
	  • Review trampoline visual, pp122 and discuss with class energy conversion and changes. **(MF)**
	  • Review and discuss "Conserving Mechanical Energy" p.127 –Skateboard ramp visuals.) **(MF)**
	PS3 (5-8) – INQ + POC–8
	Use data to determine or predict the overall net effect of multiple forces (e.g., friction, gravitational, magnetic) on the position, speed, and direction of motion of objects.
	• Text Ref:3.1 pp. 77-83 **(MF)**
	  • Reference Chapter 2.0-2.1 pp.38-45 **(MF)**
	• Investigation: How can you change an object's motion?" **(MF)**
	
	PS3 (5-8) –INQ + POC–8
	Use data to determine or predict the overall net effect of multiple forces (e.g., friction,

ESS2 (7-8)-8 **Students demonstrate an understanding of gravitational relationships between or among objects of the solar system by..** **8d** <u>describing the relationship between mass and the gravitational force between objects.</u> **8e** <u>describing the relationship between distance and the gravitational force between objects,</u> **8f** <u>explaining that the sun's gravitational pull holds the Earth and other planets in their orbits just as the planet's pull keeps their moon's in orbit.</u> **PS2 (7-8)-6** **Students demonstrate an understanding of energy by…** 6a using a real world example to explain the transfer of potential energy to kinetic energy. **PS3 (5-6)-8** **Students demonstrate an understanding of motion by…** 8a using data or graphs to compare the relative speed of objects. **Students demonstrate an understanding of force (e.g., friction, gravitational, magnetic) by…** 8b recognizing that a force is a push or a pull. 8c explaining that changes in speed or direction of motion is caused by forces. 8d showing that electric currents and magnets can exert a force on each other.	*gravitational, magnetic) on the position, speed, and direction of motion of objects.* • Investigation: How do the acceleration of two falling objects compare? P.77 • Investigation: How does gravity affect falling objects? P.82 URB p.158**(MF)** • Refer to diagram p.80 • Challenge & Extension A**(MF)** ctivity **(MF) URB p. 157** • Math in Science: p.90 Smoke Jumpers in Action • **(F&M)** • Investigation: How does design affect speed?"p.19 **(MF)** • Investigation: Inclusion activity reference p.80 teacher guide; Metal Clip balanced by gravity and magnetism **(MF)** <u>Call on prior knowledge of students from grade four - measuring magnetic force.(See Elementary Curr. Guide)</u>

PS3 (7-8)-7 **Students demonstrate an understanding of motion by…** 8a measuring distance and time for a moving object and using those values as well as the relationship s=d/t to calculate speed and graphically represent data. 8b solving for any unknown in the expression s=d/t given values for the other two variables. 8c differentiating among speed, velocity and acceleration. **Students demonstrate an understanding of force (e.g., friction, gravitational, magnetic) by…** 8d making and testing predictions on how unbalanced forces acting on objects change speed or direction of motion, or both. 8e describing or graphically representing that the acceleration of an object is proportional to the force on the object and inversely proportional to the object's mass. 8f. differentiating between mass and weight.	

Unit	**Focus Questions** (Essential Questions)	**Instructional Activities, & Investigations (INQ)**	**Big Ideas** (Understandings)
	Texts to be used: McDougal Littell& *Unit Resource Book (URB) where noted	Motion & Forces (M&F)) Space Science (SS)	
1	What is the relationship between mass and gravitational force/attraction/weight?	• Text Ref:3.1 pp. 71-83 **(MF)** • Investigation: How do the acceleration of two falling objects compare? P.77 **(MF)** • Investigation: How does gravity affect falling objects? P.82 URB p.158 • Refer to diagram p.80 **(MF)**	• Mass is the amount of matter and/or inertia of an object. • Mass is measured on a mechanical balance or inertial balance (as used in space on space station when in orbit.) • Mass does not change with location and is usually measured in the fundamental unit-the gram (kg, cg, mg, etc.). • Gravity is a force exerted on masses. • Weight varies with location and is the measure of the gravitational pull on the object. Weight changes in small amounts due to small changes to the gravitational pull of the Earth in various locations (i.e. slightly less in Denver Colorado than in Rhode Island…but not much difference.) yet mass would not change there or on the moon. Weight on the Moon is approximately 1/6 Earth. • Weight is measured in Newton's in the metric system and pounds in the Common US system (also called English System) Do Not spend a lot of time converting systems of measurement except as a general example of use of algebraic skills consistant with Math GLE's)
2	How does weight or gravitational pull vary?	• Challenge & Extension Activity **(MF)** **URB p.157** • Math in Science: p.90 Smoke Jumpers in Action **(MF)**	• As objects get further apart the gravitational pull gets less. • As objects get more massive then the gravitational attraction between them gets greater. *Misconception that this is not the cause of the

		• Orbits discussion p.81 **(MF)**	"weightless" phenomenon experienced by astronauts in orbit around the earth. They are in free fall but, still weigh only slightly less as they do on earth.
3	What keeps planets in orbit around the sun? What keeps "moon(s) orbiting planets? How does the motion and orbit of the earth relate to the night/day, seasons, tides, that we observe on earth?**	• P.80 Discussion & Reading "Gravity keeps objects in orbit." **(MF)** • Orbits Transparency T22 in Unit Transparency Book; Clsss Discussion **(MF)** • **Connect this content to what was learned specifically in grade 6, Space Science. • Reference Chapter 4.0 -4.2 pp.112-129 **(MF)** • Investigation: "How do you work?" P.115 • Investigation:"How much work does it take?" P.118 **(MF)**	• The sun's gravitational pull holds the Earth and other planets in their orbits, just as the planet's gravitational pull keeps their moons in orbit. • Tides are caused by the moon's gravitational pull on the earth due to its proximity.
4	What is the difference between potential and kinetic energy?	• Review trampoline visual, pp122 and discuss with class energy conversion and changes. **(MF)** • **Ref: Chap. 3 Energy, p71-76 (ME)* (This chapter introduces Energy)** • Review and discuss "Conserving Mechanical Energy" p.127 –Skateboard ramp visuals.) **(MF)**	• Potential energy is stored energy due to work having been done on the object. It is relative to position. • Kinetic energy is energy due to motion. The faster an object moves the more kinetic energy it has. • Both potential and kinetic energy depend on an object's mass. The more mass it has the more kinetic energy it has. • Energy can be transformed from potential to kinetic and vice versa.

5	How are position, speed, and acceleration of an object determined graphically? How do we measure distance and time for a moving object and use those values as well as the relationship s=d/t to calculate speed and graphically represent data. How do we solve for any unknown in the expression s=d/t given values for the other two variables. How do we differentiate among speed, velocity and acceleration?	• Investigation: How does design affect speed?"p.19 **(MF)** • Reference Chapter 1.0 -1.3 pp. 8-37 **(MF)** • Activity: How do you describe the location of an object? P.9 **(MF)**	• Speed is determined as the rate of change of position in a certain amount of time. • Velocity is the speed in a particular direction. • Acceleration is the change of speed or velocity with respect to time. • Speed (velocity) can be inferred-described-calculated from a position time graph by looking at the slope of the lines. • Acceleration can be inferred-described-calculated by looking at a speed (velocity) and time graph.
		• Investigation: "When does an object accelerate?" p. 27 **(MF)** • Investigation: "Acceleration & Slope", p32,33	
		• Reference Chapter 2.0-2.1 pp.38-45 **(MF)** • Investigation: How can you change an object's motion?" **(MF)** **p.41**	
6	How do we recognize when a force has been applied to an object? What do forces do to the motion of an object? How do multiple forces such as friction and others affect the motion of an object (net force)? How does current affect magnetic force? How is magnetic force measured? (See grade 4 FOSS M&E Kit)	• Reference Chapter 2.2 pp. 49-55 **(MF)** • How are force and acceleration related? P. 49 **(MF)** •	• A force is a push or pull • Net forces applied to an object change the motion of an object by either changing the speed and/or direction of the motion of the object. • The strength of an electromagnet is determined by the current and the number of "windings" around the object to be magnetized. *This is an opportunity to make prior knowledge connections to students grade four kit experiences with Magnetism & Electricity Kit. See Elementary Curriculum.
		• Reference Chapter 2.3 p-p.57-61 & 3.2 p.85-89 **(MF)** • Investigation:" Friction in Air" p. 88 How does the shape of an object affect how it falls?	
7		• Investigation: Inclusion activity reference p.80 teacher guide; Metal Clip balanced by gravity and magnetism **(MF)** • Call on prior knowledge of students from grade four - measuring magnetic force.(See Elementary Curr. Guide)	