

CT Science Standard 8.1 – Force and Motion

An object’s inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.

Post Visit Activities

The following highlighted GLE’s and GLC’s are covered in this section:

<i>Force and Motion – What makes objects move the way they do?</i>			
GRADE 8			
8.1 — An object’s inertia causes it to continue to moving the way it is moving unless it is acted upon by a force.			
Core Science Curriculum Framework	Underlying Concepts <i>Students should understand that...</i>	Grade-Level Expectations <i>Students should be able to...</i>	CMT Expected Performances
<p>8.1.a The motion of an object can be described by its position, direction of motion and speed.</p> <p>8.1.b An unbalanced force acting on an object changes its speed and/or direction of motion.</p> <p>8.1.c Objects moving in circles must experience force acting toward the center.</p>	<p>GRADE-LEVEL CONCEPT 8.1.a</p> <ol style="list-style-type: none"> An object is said to be in motion when its position changes in relation to a point of reference. An object’s motion can be described and represented graphically according to its position, direction of motion, and speed. Speed describes the change in an object’s position over a period of time, and is measured in units such as meters per second or miles per hour. Average speed takes into account the different speeds at which an object moves over a period of time. Average speed is calculated by dividing the total distance traveled by the change in time, regardless of any changes in motion or direction during its travel. Motion of objects can be represented on a distance vs. time line graph, with distance traveled as the vertical (“y”) axis and time as the horizontal (“x”) axis. The steepness and slant of the motion line vary depending on the speed and direction of the moving objects. A straight horizontal line indicates an object at rest. <p>GRADE-LEVEL CONCEPT 8.1.b</p> <ol style="list-style-type: none"> In order for an object to change its motion, a push/pull (force) must be applied over a distance. Forces can act between objects that are in direct contact, or they can act over a distance. There are forces of attraction, such as gravity or magnetism, and forces of resistance, such as friction and drag (air resistance). Forces are measured in Newtons or pounds using scales. Forces can act simultaneously on an object from all directions with different strengths (magnitudes). When the magnitude and direction of all the forces acting on 	<ol style="list-style-type: none"> Demonstrate how forces, including friction, act upon an object to change its position over time in relation to a fixed point of reference. Calculate the average speed of an object and distinguish between instantaneous speed and average speed of an object. Create and interpret distance-time graphs for objects moving at constant and nonconstant speeds. Predict the motion of an object given the magnitude and direction of forces acting upon it (net force). Investigate and demonstrate how unbalanced forces cause acceleration (change in speed and/or direction 	<p>C22. Calculate the average speed of a moving object and illustrate the motion of objects in graphs of distance over time.</p> <p>C23. Describe the qualitative relationships among force, mass and changes in motion.</p> <p>C24. Describe the forces acting on an object moving in a circular path.</p>

CT Science Standard 8.1 – Force and Motion

An object’s inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.

	<p>an object are combined, or added together, the total force (net force) determines the object’s motion. Forces in opposite directions are subtracted; forces in the same direction are added.</p> <p>4. If the strength of all the forces acting on an object from one direction is equivalent to the strength of the forces from the opposite direction, then the forces cancel each other out, and are said to be balanced. Balanced forces keep an object moving with the same speed and direction, including keeping it at rest.</p> <p>5. If the net force acting on an object is not zero, then the forces are said to be unbalanced, and the object’s speed or direction will change, changing its motion (acceleration). Acceleration is any change in motion, and occurs when something speeds up, slows down or changes direction. On a position time graph, this would be indicated by a change in the steepness of the motion line, or by a curved line.</p> <p>6. The greater the unbalanced force on an object, the greater its change in motion (acceleration). The greater the mass of an object, the greater the force needed to change its acceleration. Given the same amount of force, an object with a greater mass will change acceleration less. The total net force acting on an object can be determined by measuring its mass and change in motion (acceleration).</p> <p>GRADE-LEVEL CONCEPT 8.1.c</p> <p>3. Some objects continuously change direction without changing speed, causing them to move in a circular path. Circular motion is caused by a constant unbalanced force that is constantly changing direction and pulling towards the center. If there were no force pulling the object toward the center, it would continue to move in a straight line in the direction it was moving before the force was removed.</p> <p>SCIENTIFIC LITERACY TERMINOLOGY: Motion, point of reference, speed, constant speed, average speed, position-time graph, slope, force, friction, gravity, inertia, mass, acceleration, balanced/unbalanced forces, net force, circular motion</p>	<p>of an object’s motion).</p> <p>6. Assess in writing the relationship between an object’s mass and its inertia when at rest and in motion.</p> <p>7. Express mathematically how the mass of an object and the force acting on it affect its acceleration.</p> <p>8. Design and conduct an experiment to determine how gravity and friction (air resistance) affect a falling object.</p> <p>9. Illustrate how the circular motion of an object is caused by a center seeking force (centripetal force) resulting in the object’s constant acceleration.</p>	
--	---	---	--

CT Science Standard 8.1 – Force and Motion

An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.

Post-Visit Activity Two Parachutes

The study of force and motion, coupled with the experiences of the pre-visit activities, the CSC classroom activity, and the visit to the galleries in the Science Center that also pertain to force and motion can now be discussed in total.

Post Visit Assessment

Students will work in small groups to construct square parachutes of various sizes. Students will take turns dropping the parachutes, observing the drops, and timing and recording their observations on a data sheet. The students use the data obtained to create a bar graph so that comparisons can be made.

Objective:

Students will:

- Work in small groups to construct parachutes
- Measure sides of a square in centimeters
- Predict how long it will take the parachutes to descend to the ground
- Work cooperatively to obtain and record data
- Complete a bar graph using collected data
- Use data to draw conclusions about the relationship of parachute size to the time of descent

Materials:

- Pencils
- Scissors
- String
- Tape
- Glue Stick
- Ruler
- White plastic garbage bag (24" x 28")
- Permanent Markers – optional for decorating parachute
- Timer/Stop watch
- Data Sheet

Each Parachute requires:

- 1 square piece of plastic bag
- 122 cm (48") of string cut into 4 equal lengths
- Tape for string
- Metal Washers (as weights)

CT Science Standard 8.1 – Force and Motion

An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.

Activity:

1. Organize students in groups of 2 or 3 and have them decide on which task they will perform
2. Distribute the necessary materials to each group. Measure four separate squares on the plastic bag and label 25 cm, 28 cm, 30cm, and 33cm on the corresponding parachute.
3. Review any safety instructions. Take turns to drop the parachutes so that there are no accidents.
4. Construct the parachutes. Follow the directions and create each parachute the same way.
 - a. Cut the long string into four equal pieces by folding it in half, then in half again. Cut on the folded ends.
 - b. Lay the plastic square flat and attach one string to each corner with a small piece of tape.
 - c. Gather the four loose ends of string and tie them onto 2 or 3 metal washers. Use the same amount of washers for each trial.
5. When everyone has made their parachutes review the technique for dropping parachutes. If you are in a classroom, a simple technique is to pinch the top of the parachute gently, hold at arm's length above your head, and drop.
6. Next step is to practice how to time your drop with timer/stop watch.
7. Review the datasheet together and assign a recorder for each group.
8. Each student should record their predictions about the duration of the fall.
9. Students take turns dropping parachutes while the recorder gathers the information for the group. After each drop other group members can fill in their individual data sheets.
10. When all groups are done, each group should complete a bar graph with their findings.
11. Come together and allow each group to share their findings.

Note: Students should conclude the larger parachute; the slower it will drop because it catches more air, creating more drag: therefore slowing the rate of descent.

CT Science Standard 8.1 – Force and Motion

An object's inertia causes it to continue moving the way it is moving unless it is acted upon by a force to change its motion.

Parachute Drop Data Sheet

Name:

Predictions and Observations:

Parachute	Trial 1 (seconds)	Trial 2 (seconds)	Difference (seconds)
25cm			
28cm			
30cm			
33cm			

Use the data from the Actual Time column to fill in the bar graph below:

